PREGNANT WOMEN AS AN EFFECTIVE TARGET FOR PREVENTIVE PERIODONTAL INTERVENTION

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SUMMARY

Gingivitis and periodontitis are periodontal diseases common to all populations. Gingivitis is a non-specific infection by plaque bacteria while periodontitis is a group of diseases resulting from the interplay of different host responses to specific groups of plaque bacteria.

An increased gingival response to plaque occurs during pregnancy, but the exact cause of this has not been determined. The common occurrence of this condition is a general reflection of the prevalence of gingivitis and the inadequate control of dental plaque in the community.

Periodontal diseases can be prevented and controlled by regular effective plaque removal. This is carried out by the individual using the toothbrush, interdental cleaners and oral hygiene aids supplemented by regular professional care. Periodontal health must therefore be promoted by appropriate preventive interventions in the community.

These interventions must aim at improving individual preventive behaviour through greater attention to preventive dental care and public education campaigns. Public education programmes can create a greater awareness of periodontal diseases. These must be supported by greater emphasis towards individual dental health education and motivation based on behavioural strategies. Such individual and community programmes can be effective if they are targeted on selected key individuals or groups in the community. These individuals or groups must be either influential role models or important decision makers in society.

It is believed that mothers are influential role models for their children. It has also been shown that pregnancy is an opportune period for oral health education. Therefore, oral health education targeted on pregnant women can be an effective strategy for preventive periodontal intervention in the community.

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To Jeff Paul and Philip Hwang

In delight - in appreciation - in love

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1. INTRODUCTION

Research has shown that gingivitis and periodontitis have a universal distribution. Recent data from the Global Oral Data Bank of the World Health Organisation show that there are low or moderate levels of gingivitis and periodontitis in industrialised countries, and generally high levels of disease in developing countries. Data have also demonstrated a close association between poor oral hygiene and high disease levels in different countries (Barmes 1984). It is therefore clear that an adequate level of oral hygiene across communities, is necessary to prevent and control periodontal diseases (FDI 1984).

Clinical research into the aetiology and pathogenesis of periodontal diseases, has further provided knowledge to establish the scientific basis for prevention of gingivitis and periodontitis. Effective regular removal of dental plaque has been shown to prevent these diseases. However, it is generally accepted that the oral hygiene practices of many individuals are inadequate to ensure periodontal health. Considerable time and effort are required to improve the oral hygiene status of an individual. Even greater efforts are required to improve the oral hygiene levels in the community. For these reasons, there is a need to develop effective programmes for the improvement of oral hygiene in the individual as well as the community.

Oral hygiene programmes in the community have often been given limited attention because of their seemingly ineffective results. This apparent failure of oral health education programmes under real life conditions, may be due to complex social and behavioural barriers to the effective application of preventive

measures. Individual skill deficits and a lack of preventive behaviour often compound the organisationla, social and economic obstacles of limited resources. There is thus a need to develop strategies to overcome these barriers.

Strategies are necessary to maximise resources and to overcome constraints in preventive periodontal programmes. Effective prevention can be achieved through oral health education programmes directed at key individuals or target groups. It has been suggested that pregnant women are considered to be an important target group for preventive periodontal intervention (Fanning, Barrett, Cellier 1966; Jago, Aitken, Chapman 1984). This is because the exacerbation of gingivitis during pregnancy is well recognised by the dental profession and widely experienced by pregnant women. The prevention of this condition during pregnancy has therefore received considerable attention.

Studies on gingivitis during pregnancy have shown that whatever the cause for the exacerbation of gingivitis may be, the condition can be prevented by effective control of dental plaque (Silness, Loe 1966; Doust, Radalj, Wong-Lee, Phillips 1985). Studies also indicate that pregnant women in this period of their lives, are highly receptive to dental health information (Silness, Loe 1966; McKegg 1984). By targeting preventive periodontal programmes for pregnant women, the impact of dental health education can be highlighted and the "trickle down" or diffusion effect of appropriate oral hygiene practices to future generations will be facilitated. Ultimately, this increased dental health education targeted on pregnant women, would produce greater benefits to periodontal health in the community, for both the short and longer term.

The aim of this treatise is to focus on the prevalence and difficulties in control of gingivitis and periodontitis in the community. It will discuss the preventive measures that are available to prevent and control these diseases in individuals and the community. The planning and selection of some appropriate strategies and target groups for a more effective application of preventive periodontics with emphasis on dental health education, will be discussed. This treatise will also explore the studies of gingivitis during pregnancy and discuss why the prevention of this condition in pregnant women can be exploited as an effective strategy for preventive periodontal intervention in the community.

2. GINGIVITIS AND PERIODONTITIS

2.1 CONCEPTS

The earliest modern recorded attention given to gingivitis and periodontitis was by Pierre Fauchard in the 18th century, when he described the condition which came to be known as pyorrhoea alveolaris. His scurvy theory of the condition was rejected by Desirabode in 1843. Around the same period, Bourdet attributed the cause of the disease to calculus, hygiene and constitutional factors. These beliefs and assumptions were historically recorded by Walter Hoffmann-Axthelm in his History of Dentistry, published in 1981 (Hoffmann-Axthelm 1981). It was only in the early years of this century that microorganisms became linked with the disease. However, the calculus cause was only finally abandoned in 1965, following the classical experimental study of Loe and his coworkers (Loe, Theilade, Jensen 1965).

The early concepts of gingivitis and periodontitis assumed that inflammation and suppuration of the gingivae and alveolar bone occurred when there were local and constitutional causes present. It was believed that the inflammation started in the gingival tissues, proceeding to damage the cementum of the teeth and the alveolar bone, causing loosening of the teeth (Hoffmann-Axthelm 1981). Following the emphasis given by Hunter to the bacterial cause of human infections, there was greater attention given to microorganisms as the cause of periodontal disease (Gold 1985). By the end of the 1960's, it was clearly established that plaque bacteria and their products caused gingivitis and periodontitis (Theilade, Wright, Jensen, Loe 1966).

In the late 1960's and throughout the 1970's, research was centred upon plaque microbiota and host responses. Thus, individuals with extensive periodontal disease were suspected of having inadequate home care or a weakened resistance to the accumulated microbiota of plaque, or both (Socransky, Tanner, Haffajee, Hillman, Goodson 1982). Research was focused on the nature of the interaction between bacterial products and various host defence mechanisms (Ivanyi, Lehner 1971; Seymour, Powell, Davies 1979).

By the late 1970's and early 1980's, there was rapidly accumulating evidence that specific bacteria or unique groups of bacteria were associated with the various clinical forms of periodontal disease (Genco 1981). Several distinctly different forms of periodontitis in humans could be identified. These were categorised by Page and Schroeder as prepubertal, juvenile, rapidly progressive, adult periodontitis, and acute necrotising ulcerative gingivoperiodontitis (Page, Schroeder 1982). In summarising the specific plaque research evidence, Page and Schroeder concluded that microbiological studies supported the concept that various forms of periodontal disease represent infections by different specific groups of microorganisms.

At the same time that specific groups of microorganisms were being linked to the different periodontal diseases, research was also showing that periodontal disease was not a slow chronic disease that progressed uniformly around all teeth. Instead, the evidence was that some teeth appeared to be more susceptible while others were more resistant (Socransky, Haffajee, Goodson, Lindhe 1984). Evidence also appeared to show that periodontal diseases progressed by recurrent acute episodes with periods of remissions (Goodson, Tanner, Haffajee, Somberger, Socransky 1982). These bursts of activity

occurred randomly for short periods of time in individual sites (Socransky, Haffajee, Goodson, Lindhe 1984). In addition to these new concepts of periodontal diseases, the complex host factors, which are involved in periodontal disease susceptibility, in defence and in tissue destruction, are still being further investigated (Genco, Slots 1984).

2.2 THE ROLE OF DENTAL PLAQUE

The bacterial aetiology of gingivitis was clearly demonstrated by Loe and his coworkers in 1965 (Loe, Theilade, Jensen 1965). Loe showed in a study on 12 healthy dental students that upon cessation of oral hygiene procedures, all students developed signs of gingival inflammation within 10 to 21 days. Upon resumption of oral hygiene procedures, the gingival changes resolved.

It is now widely accepted that accumulation of plaque on teeth leads to gingival inflammation (Saxen 1985). It is also established that during the transition from normal to inflamed gingiva, the bacteria of the accumulating plaque change from a relatively simple to a more complex flora. Initially, plaque has a predominantly Gram positive flora with increasing numbers of Gram negative cocci and rods appearing after 1 to 2 days of undisturbed plaque accumulation. As plaque becomes older, there is a proliferation of fusobacteria and filaments with more vibrios and spirochaetes. The appearance of inflammation coincides with the formation of this complex flora (Saxen 1985). This was shown by Listgarten when he studied the development of plaque on epoxy resin crowns placed on five or more teeth in volunteers who abstained from cleaning these teeth during the stay of the crowns in the mouth (Listgarten, Mayo, Tremblay 1975). As gingivitis developed around the crowned teeth, Listgarten found a

marked increase in spirochaetes in the plaque flora, and an increasing proportion of actinomyces filaments.

Other workers have since shown that species of Actinomyces, Fusobacterium, Lactobacillus, Veillonella, Streptococcus and spirochaetes coincided most closely with the development of gingivitis (Holderman, Burmeister, Moore 1982). In the development of destructive periodontal diseases, certain groups of bacteria appear to be associated with the different types of periodontal lesions. Actinobacillus actinomycetemcomitans and Capnocytophaga are often found in lesions designated as juvenile periodontitis. Bacteroides gingivalis, Fusobacteria and spirochaetes are associated with rapidly progressive periodontitis. Adult periodontitis typically harbour Bacteroides melaninogenicus, Eikenella corrodens, spirochaetes and Actinomyces (Page, Schroeder 1982).

The accumulation of bacteria both supra and subgingivally results in the development of gingivitis and periodontitis. Bacterial surface components or products interact with the host cells and tissues causing an inflammatory response. This is brought about by a direct action of bacterial components on the host tissues or indirectly by the stimulation of the host immune responses or from a combination of these effects (Holt 1982).

2.3 THE RELATIONSHIP OF GINGIVITIS TO PERIODONTITIS

New concepts of destructive periodontal disease have designated periodontitis as being a group of at least 4 or 5 related diseases (Page, Schroeder 1982). These have been termed prepubertal periodontitis, juvenile periodontitis, rapidly progressive periodontitis, adult periodontitis and acute necrotising ulcerative gingivo-periodontitis (Page, Schroeder 1982). With their differing

aetiology, pathogenesis, progression, natural history and response to treatment, these diseases cannot be conceived as natural extensions of gingivitis.

Although it is now accepted that not all gingivitis progresses inevitably to periodontitis, the consensus is that gingivitis is present before there is periodontal destruction (Loe 1983). The conversion of a gingivitis to periodontitis has only been shown in dogs (Lindhe, Hamp, Loe 1973), while in humans, the progression of gingivitis to periodontitis is unpredictable but not inevitable.

The reason for conversion of a gingivitis to a periodontitis is obscure but a number of hypotheses exist. Page and Schroeder have proposed that either the introduction of highly virulent bacteria or a modification in host response which exacerbates the disease, may be responsible for this conversion (Page, Schroeder 1982). A change in the host's immunological response was suggested by Seymour, whereby a shift in a predominantly T-cell lesion to a B-cell lesion, results in a chronic inflammatory periodontal lesion becoming a progressive lesion with tissue destruction (Seymour, Powell, Davies 1979).

Socransky looked at various possible prerequisites for development of a destructive periodontitis. He stated that conditions must be suitable for colonisation and subsequent growth of the microorganisms. The pathogens had to multiply to numbers that exceeded some threshold level for host defence responses. A "triggering" event might be required to initate a destructive phase. This could be a local factor such as the arrival or loss of an accessory species of bacteria, food impaction or trauma, or a systemic factor

such as stress. Microbial species inhibitory to the pathogen would have to be absent or low in numbers. Sufficient time would have to be available for completion of the pathological cycle. In addition, factors such as age, compromised polymorphonuclear leucocyte function, specific antibody responses and endocrine or dietary factors could influence host susceptibility (Socransky, Tanner, Haffajee, Hillman, Goodson 1982).

The multiplicity of local and host factors would make the conversion of a stable periodontal infection to a progressive lesion, a complex development. There are at present, no known methods of predicting whether or when a gingival inflammation will progress to destroy the deeper periodontal tissues.

2.4 THE PREVALENCE OF GINGIVITIS

There have been difficulties in assessing the prevalence, severity and progression of gingivitis in the population. The many early studies on gingivitis in humans, used simple methods of survey design. There was a lack of uniform criteria for indices resulting in inconsistent results. As a consequence, data were not reproducible, were confusing, and could not be easily interpreted or compared. An example of an early study on gingivitis was made by Brucker using subjective clinical interpretation of gingivitis (Brucker 1943). In a study of children aged 14 to 16 years attending public school, he found a prevalence of gingivitis of 8.7%. This was a low prevalence compared with the research of some other workers. For instance, Schour and Massler found approximately half the children aged 6 to 10 years that they examined had gingivitis (Schour, Massler 1947). Marshall-Day and Shourie found a prevalence of 97% gingivitis in children aged 9 to 17 years (Marshall-Day, Shourie

1944). With a better understanding of gingivitis and of research methods today, the differences in gingivitis prevalence in these early studies, may be explained by the lack of objective criteria and of uniformity in data collection. Other factors which gave rise to the differences may be the effects of socio-economic variations in the samples. A factor like oral hygiene status would have accounted for some of the variations.

In an attempt to standardise criteria so that data could be compared, Massler developed the PMA index. This was a quantitative measure of gingivitis through recording the number of gingival units affected, papillary (P), marginal (M) and attached (A) gingiva (Massler, Schour 1949). With this index, Massler and his co-workers studied 6 to 17 year old children in Chicago and Philadelphia. They found a 90% prevalence of gingival inflammation in, on average, 9 sites per child (Massler, Cohen, Schour 1952).

In 1954, Kruger using the PMA index, found a high prevalence of gingivitis in a sample of children aged 3 to 13 years, in Australia (Kruger 1955). Using the same index, Muhlemann and Mazor studied children 7 to 16 years of age in Zurich (Muhlemann, Mazor 1958). They found that at age 7 years, 75% of the children had gingivitis. By age 13 years, 93% had developed the inflammation. In 1963, using a different index, Ramfjord's Periodontal Disease Index (Ramfjord 1959), Jamison found gingivitis present in over three quarters of his sample of 118 patients aged 5 to 14 years old (Jamison 1963).

Using his own criteria for inflammation based on changes in colour, oedema, and bleeding, McHugh examined the gingival status of 13 year old children in Scotland. He found a prevalence of 99%

gingivitis which might be explained by the increased sensitivity of his index criteria and the age group of his children. The increased gingivitis in 13 year old children would be likely to be due to the influence of puberty hormonal changes (McHugh, McEwen, Hitchin 1964).

In 1969, Sheiham used Russell's Periodontal Index (Russell 1956) to examine his group of children. He found that 99% had gingival inflammation. His group of children ranged in age from 11 to 17 years (Sheiham 1969). Two years later, Russell found that gingival inflammation was present in all the more than ten population groups that he examined around the world. In the survey, Russell found a consistent correlation between poor oral hygiene and periodontal inflammation (Russell 1971).

Reporting on the oral health survey of New Zealand in 1976, Cutress stated that the survey revealed a predominance of gingivitis in the population with less than 4% having healthy gingivae (Cutress 1984). He was concerned by the finding because of the well developed school dental services in New Zealand and the accepted practice of toothbrushing as a social norm in the country. The gingival health of New Zealanders appeared to be no better than those of a group of Western Samoans living in underprivileged conditions (Camrass 1974).

A recent survey in Sweden showed that almost all children had gingivitis. The survey found that at age 3 years, 36% of children had gingival inflammation. At age 5 years, 64% had inflammation, while at age 10 years, 97% had developed gingival inflammation (Hugoson, Koch, Rylander 1981).

In another recent survey of 11 to 12 year old children, Addy and his team found bleeding on probing the gingivae of all the

1015 children examined. They reported that all children had evidence of gingivitis in a few sites to all sites that were probed, while no children were found to be plaque free. It should be noted that bleeding on probing is the accepted objective criterion for disease today, so that this study clearly showed the high prevalence of gingivitis in all children (Addy, Dummer, Griffiths, Hicks, Kingdon, Shaw 1986).

Although gingivitis prevalence data have been very wide ranging in all the epidemiological surveys through the years, there was a universal distribution of gingivitis in children. It may be seen that although the indices and sampling methods were not adequately standardised, the prevalence of gingivitis is clear. According to the World Health Organisation, over 80% of children in the world have gingivitis. This is much more prevalent and more severe in many Asian and African countries than in the United States of America or Scandinavia. Accurate comparison of prevalence and severity between countries has been difficult because of the different diagnostic criteria and assessment methods used (WHO 1978).

In recent years however, data based on CPITN at the WHO Global Oral Data Bank, appear to show that generally high levels of inflammation are present in developing countries in both children and adults, while low to moderate levels are present in industrialised countries (Report of a working group convened jointly by the FDI and WHO 1985).

2.5 THE PREVALENCE OF PERIODONTITIS

Studies on the prevalence of periodontitis have also been hampered by a lack of uniform and standard indices. One of the most commonly used methods for assessing the prevalence of periodontal

diseases is the examination of radiographs for manifestations of alveolar bone resorption. The widening of the periodontal ligament space on the X-ray and the decrease in density or height of the alveolar bone, were taken as evidence of periodontitis.

Using X-rays, Marshall-Day and Shourie found a prevalence of 86% periodontal disease in the 30 to 39 year age group in India (Marshall-Day, Shourie 1949). In 1956, Bossert and Marks reported a prevalence of only 18% in the 30 year age group and 32% periodontal disease prevalence in the 39 year age group in the United States of America (Bossert, Marks 1956). Their findings were far lower than those of Marshall-Day and Shourie. In 1975, Hull and his co-workers also used X-rays in their study. They found 51.5% of 14 year old English schoolchildren had chronic periodontitis affecting the first permanent molars (Hull, Hillam, Beal 1975). This was a high prevalence for children when compared with the study by Blankenstein where 0.1% of children were found to have periodontitis (Blankenstein, Murray, Lind 1978).

Due to the great variations in the data collected for periodontal disease prevalence, Stoner attempted to determine the accuracy of X-rays as a method of assessing periodontal disease. She compared X-ray measurements of alveolar bone level in relation to the cemento-enamel junction, to those made on dried skulls. Stoner found that there was a high discrepancy in the two measurements (Stoner 1972).

In 1963, Jamison used Ramfjord's Periodontal Disease Index to examine a group of 5 to 14 year old American children. He found a prevalence of periodontal disease in 25.2% of the 159 children (Jamison 1963). The prevalence of periodontal disease in another group of American children was 43% (Marshall-Day, Stephens, Quigley 1955).

In a group of 11 to 30 year olds in America, Greene found a prevalence of 92% with periodontitis based on Russell's Periodontal Index. This was similar to another group that he examined in India. Greene found that although the prevalence of periodontitis was similar, Indians of the same age groups had more severe periodontal disease (Greene 1960). Even though there was such a variation between the data gathered by different workers, there were no clear variables in the population groups to explain the wide divergence of data. Greene however, found a direct correlation between the severity of periodontal disease and oral hygiene.

In 1964, Beck found a very high prevalence of periodontal disease in an adult polynesian population. Based on the presence of periodontal pockets deeper than 3 mm, he found a dramatic increase in prevalence of destructive disease after the age of 30 years (Beck, Ludwig, Williams, Talagi 1964). In another study of polynesian people, Camrass found two thirds of the population aged 65 years of age and over, had advanced periodontal disease (Camrass 1974). In 1978, Plasschaert reported that 64% of a Dutch population had periodontal disease (Plasschaert, Folner, Heurel, Jansen, Opijmen, Wonters 1978), while Hugoson found that only 8% of a Swedish group had advanced disease based on X-ray evaluation of loss of alveolar bone height (Hugoson, Jordan 1982).

In 1982, Cutress and his workers found an almost 100% prevalence of periodontal disease in some South Pacific islanders, with a marked variation being noted in the severity of disease in the different age groups. There was an obvious increase in severity with age, with criteria based on teeth with calculus, gingival bleeding and attachment loss as measured on X-rays (Cutress, Powell, Ball 1982).

In New Zealand the gingival health of adolescents remained poor-in the 2 surveys carried out between 1976 and 1981. There was, however, an increase in the number of adolescents with completely healthy gums. The majority of adults showed signs of periodontal disease in both surveys, with 20% of those 35 to 44 years having advanced disease (Report of a working group convened jointly by the FDI and WHO 1985).

Data on the prevalence of periodontal disease in different countries have been very diverse. However, most data have shown that where populations had better oral hygiene and professional care, there was less severe periodontal disease than those without dental care and poor oral hygiene (Greene 1960; Cutress, Powell, Ball 1982). In an attempt to gather more uniform data for assessment of periodontal needs, Ainamo and his team developed the Community Periodontal Index of Treatment Needs (CPITN) which has since been used to gather data on periodontal disease (Ainamo, Barmes, Beagrie, Cutress, Martin, Sardo-Infirri 1982).

In an oral health survey using CPITN carried out in America, Beck found 30% of adults aged 45 years and over suffered pockets 3 to 6 mm deep, while 1.3% had pockets deeper than 6 mm (Beck, Lainson, Field, Hawkins 1984). Also using the CPITN, Skrikandi found 25% of an industrial population in South Australia had severe disease with only 4% being completely free of disease (Skrikandi, Clarke 1982). This prevalence was higher compared with Beck's study, but may be explained by the lower socio-economic status of the group.

In 1984, in the Brisbane statistical division survey of adult oral health, only 3.3% of adults required complex periodontal treatment. For the age group 55 to 64 years, advanced disease was present in 7.3% while 11.3% of those over 65 years had advanced

disease (Powell, McEniery 1984).

In a patient assessment using CPITN, at Westmead Hospital Dental Clinical School in New South Wales, it was found that periodontal disease was very prevalent, affecting 98% of patients 15 years and over, and 80% of those under 15 years old. In most patients however, the disease was mild to moderate in severity. Advanced disease was evident in only 15% of those over 15 years old (Sivaneswaran 1985). Patients attending Westmead Hospital belong to a lower socio-economic group which would explain the bias towards a higher prevalence of more severe disease. This was to be expected from past data reported by the World Health Organisation which linked lower standards of living and lower educational levels to more severe disease (WHO 1978).

The emerging data on periodontal disease show that it is moderate in the developed countries, with a greater disease severity in those of a lower socio-economic status. The estimates of recent data using CPITN, show that 10 to 15% of individuals have advanced periodontal attachment loss and could be considered to be at risk of losing teeth through the disease if untreated (Gjermo 1984). This is in contrast to early data based on surveys utilising Russell's Periodontal Index which gave a picture of the widespread prevalence of severe periodontal disease (WHO 1978).

The working group of the FDI and WHO reported recently that the emerging global picture of periodontal diseases was that there was generally low or moderate levels of bleeding and calculus in industrialised countries, with generally higher levels in developing countries, with 10 to 15% of individuals considered at risk of succumbing to the progressive form of periodontal disease (Report of

a working group convened jointly by the FDI and WHO 1985).

2.6 STUDIES ON GINGIVITIS DURING PREGNANCY

2.6.1 Early Studies

There have been many studies on the frequency of occurrence of gingivitis during pregnancy. As early as 1933, Ziskin reported that less than 40% of pregnant women in their study suffered gingivitis (Ziskin, Blackberg, Slanetz 1933). This was assessed by the presence or absence of gingival inflammation, the extent of the inflammation and the tendency to bleeding. In 1949, Maier and Orban in their study of pregnant women, found that 55% had gingival inflammation based on clinical inflammation using criteria of mild, moderate and severe (Maier, Orban 1949). A year later, using histological back up, Hilming found that gingivitis was either present or it developed during pregnancy. He found the inflammation present in all the pregnant women that he examined. The severity of the gingival inflammation was also greater when compared to gingival inflammation in normal women (Hilming 1950).

In 1960, Hasson found that gingivitis occurred in 30% of pregnancies (Hasson 1960), while Ringsdorf and his co-workers using the PMA Index, found that 72% of pregnant women suffered gingivitis (Ringsdorf, Powell, Knight, Cheraskin 1962). This was further confirmed by Erb and Brzezinsky who reported 70% prevalence of pregnancy gingivitis in their study based on mild, moderate and severe gingival inflammation (Erb, Brzezinsky 1963).

The variations in findings of 30% to 100% was probably due to differences in criteria and opinion regarding gingival changes. In the early years, criteria for gingivitis were subjective and

imprecise. There were no objective and well defined indices for measuring gingival inflammation. It may be observed that when based on both clinical as well as histological assessments, Hilming found the prevalence to be 100%. While the criteria in these early studies were not standardised and therefore not fully comparable, all the studies show a high prevalence and an increasing severity of gingivitis during pregnancy. In an effort to determine the nature of this increased inflammation, many more studies have since been carried out.

2.6.2 Studies to Demonstrate Gingival Changes in Pregnancy

One of the earliest systematic studies on the periodontal health of pregnant women, was carried out by Loe and Silness in 1963. The aim of their study was to use better defined index systems to assess the oral hygiene status of pregnant women and to correlate it with their gingival condition (Loe, Silness 1963).

The group of pregnant women in the study were public patients of a maternal and child health centre in Oslo. They belonged mainly to the working class or the lower middle class of the society. All the examined women were between 2 to 9 months pregnant with a mean age of 25.3 years and had a range in age between 18 to 34 years.

The periodontal condition of the women was based on Russell's Periodontal Index (Russell 1956). The scores on a scale of 0 to 8 were based upon the clinical signs of marginal periodontitis according to Russell. The degree of disease status was taken as the average score for the teeth in the oral cavity. Generally, there were 3 main grades of severity, those with gingivitis, those with destructive disease and those with advanced disease. Although the index was based on objective criteria, these criteria were open to

interpretation by each examiner when deciding on the score.

The gingival condition of the women was assessed according to the criteria of a Gingival Index System proposed by Loe and Silness themselves (Loe, Silness 1963). This index was based on the clinical characteristics of the different grades of inflammation. The index could be applied to different areas of the gingivae around each tooth. In that way, the gingival condition was well assessed for each and every tooth, and an average score could be calculated for all the teeth.

According to the indices used, Loe and Silness found 100% of the women showed signs of gingival inflammation during pregnancy. The prevalence and severity was significantly higher than in the women post-partum. The increase in severity was noticeable at the second month of pregnancy, reaching a maximum at the eighth month. Thereafter the inflammation declined to the level observed before the second month of pregnancy. There were no lasting injuries to the periodontium as a result of the increased inflammation during pregnancy. Although gingival crevice depths were increased during pregnancy, it was actually due to the enlargement of the gingivae from the increased inflammation (Loe, Silness 1963).

All the women in the study had gingivitis and periodontitis, as determined by the indices. It may be noted that the Gingival Index of the authors, and the composite Russell's Periodontal Index, measured the same parameters to a limited extent. The main difference is that the Gingival Index measured gingival inflammation only, whereas the Periodontal Index measured, in addition to gingival inflammation, destructive periodontal disease.

The study compared two groups of women, 121 pregnant women and 61 post-partum women (Loe, Silness 1963). It was a cross-sectional study, so that the differences reported between the pregnant and non-pregnant women, may not be completely comparable. Furthermore, there was no statistical calculation of the group differences for plaque and inflammation to indicate if the differences were clinically significant. Also, the gingival index was not sufficiently sensitive to detect small changes of inflammation that might have occurred. A more sensitive gingival index would be better able to show any minor inflammatory changes. Compared with other studies, the mean gingival index of the pregnant women was higher. This was because the women were in varying stages of pregnancy from 2 to 9 months whereas other studies examined women in the first trimester (Samant, Malik, Chabra, Devi 1976; Doust, Radalj, Wong-Lee, Phillips 1985).

In 1969, El-Ashiry and his co-workers studied the gingival status of pregnant Egyptian women during the different stages of their pregnancy (El-Ashiry, El-Kafrawy, Nasr, Younis 1969). They found that the greatest change occurred in the gingivae during the first trimester. This inflammatory change remained severe during the second trimester but was further aggravated during the third trimester. Their findings were similar to those of Loe and Silness in 1963. They also observed, as in Loe's study, that there was no significant variation in the oral hygiene and calculus status during the period of pregnancy. This suggested that the increased gingival inflammation was not due to greater neglect of oral hygiene by pregnant women, but that the gingivae were in some way influenced by pregnancy.

In a longitudinal study of periodontal changes during pregnancy, Cohen and others attempted to document the prevalence and periodontal changes during pregnancy (Cohen, Friedman, Shapiro, Kyle 1969) and to relate them to local tooth deposits. Cohen and his workers used a modified version of the Periodontal Screening Examination of O'Leary to assess the periodontal status. This was an index incorporating both gingival and periodontal disease states (O'Leary 1967). Local deposits on the teeth were assessed as either hard or soft deposits, and were also examined according to extent of distribution relative to the gingival margins of the teeth. This was useful for relating cause and effect.

Cohen's longitudinal study in 1969 confirmed the findings of Loe and others that inflammation increased in the gingivae during pregnancy, and that this increase was not related to any deterioration in oral hygiene. Although there appeared to be an increase in periodontal disease, this was because the composite nature of the index allowed the gingival changes to become the major influence on the increased periodontal scores. The gingival index scores showed a high correlation with both the soft and the hard deposits. In fact, soft deposit scores were exceptionally high at every examination, indicating a high degree of poor oral hygiene in the group of pregnant women. There was also a greater correlation between calculus and gingival inflammation than between plaque and gingival inflammation during pregnancy. This suggested that scaling was important to gingival health during pregnancy. Cohen also found some loss of periodontal attachment which unlike the gingival inflammation, did not completely revert 3 months postpartum. This loss of attachment was however, not statistically significant (Cohen, Friedman, Shapiro, Kyle 1969).

In a study by Adams in 1974, 97 pregnant women were compared with 92 non-pregnant women (Adams, Carney, Dicks 1974). The stage of pregnancy varied from 3 to 9 months while the non-pregnant women were made up of post-partum and non-pregnant women. A significant difference in gingival inflammation was found between the pregnant and non-pregnant groups, with a higher degree of inflammation in the former. Oral debris scores were statistically lower in the pregnant group than in the non-pregnant one. These findings gave a closer relationship between oral debris and gingival inflammation in the non-pregnant women. This observation was similar to those of Loe (1963) and Hugoson (1971), and showed a poor correlation between plaque and gingivitis during pregnancy.

This study by Adams (1974) scored gingival inflammation by the changes in the interdental papillae only, unlike the assessments in the studies by Loe, Hugoson and others, where all the gingivae around the teeth were examined. The criteria used in Adams' study were for reasons of simplicity and speed. There would thus appear to be a discrepancy between scoring the papillary condition and scoring the oral debris on the facial surfaces of teeth and then correlating the scores. However, the scores still showed a correlation between gingivitis and oral debris, with a higher correlation in the non-pregnant group compared with the pregnant group.

The study also showed the high incidence of gingivitis in pregnant women. The progressive worsening of gingival inflammation as pregnancy advanced, was not accompanied by a deterioration of oral hygiene. This was a similar observation made by Loe and others. In fact, Adams (1974) found an improved oral debris score in his group of pregnant women as pregnancy progressed. The increased inflammation in this group was therefore a contradiction to the expected improve-

ment in gingival inflammation when plaque is reduced. The improved oral hygiene in the pregnant women may have been due to improved motivation towards self care and all personal health matters during pregnancy. The reduced levels of plaque on teeth may also have been due to conditions that develop in the oral cavity during pregnancy. For instance, there could be alterations to the composition of saliva or gingival fluid affecting the formation and adhesion of plaque. Thus the reduced correlation between plaque and gingivitis during pregnancy, would suggest that there may be other factors contributing towards gingival inflammation during pregnancy.

In a study of pregnant women at a hospital in Baltimore, Arafat examined their gingival status throughout their pregnancy (Arafat 1974). Using Russell's Periodontal Index (Russell 1956), and the Oral Hygiene Index of Greene and Vermillion (Greene, Vermillion 1960), he found that 76.7% of the women had gingivitis. The inflammation worsened as the pregnancy advanced. This was statistically significantly different when compared with a control non-pregnant group of women. There was no statistical difference in oral hygiene status between the two groups.

Arafat also observed that clean mouths did not develop gingival inflammation during pregnancy. He concluded that hormonal changes of pregnancy were predisposing factors for increased gingival inflammation, but plaque was the precipitating factor in the production of pathologic changes. This study again highlights the importance of effective plaque control to prevent gingivitis during pregnancy.

In 1976, Samant showed a progressive increase in gingival inflammation in pregnant women (Samant, Malik, Chabra, Devi 1976).

He and his co-workers based their study on a cross-section of 40 pregnant women in each of the 3 trimesters of pregnancy, and a similar number of non-pregnant women as controls. Using Loe's Gingival Index (Loe, Silness 1963) and Russell's Periodontal Index (Russell 1956), they found that the number of pregnant women with moderate to severe gingivitis was significantly higher than in the non-pregnant control group. Gingival changes showed a greater correlation with the calculus and debris scores in the pregnant women than the non-pregnant women. This was a finding similar to that of other workers. The severity of gingivitis was maximum in the second trimester. This was similar to Cohen's study (Cohen, Friedman, Shapiro, Kyle 1969) but differed from Loe's finding which was that the maximum severity was in the third trimester. These differences arose because of the difference in study design. Both Samant (Samant, Malik, Chabra, Devi 1976) and Loe's (Loe, Silness 1963) studies were cross-sectional studies whereas Cohen's study (Cohen, Friedman, Shapiro, Kyle 1969) was longitudinal. It would be presumed that a longitudinal study design would give a more accurate interpretation of changes in gingival inflammation during pregnancy.

Hugoson's study, in 1971, followed gingival changes and plaque levels in 26 women during pregnancy and for 20 weeks post partum (Hugoson 1971). He used the Plaque Index of Silness and Loe (Silness, Loe 1964) and the Gingival Index of Loe and Silness (Loe, Silness 1963). Hugoson's study was longitudinal in design, giving his findings greater meaning when assessing and comparing differences and changes during pregnancy and after parturition. A deficiency in his study was that there were no controls.

All the women in his study had gingivitis and plaque deposits on their teeth. As pregnancy advanced, the existing gingivitis increased in severity. This severity regressed substantially during the post partum assessments. As in other studies, areas of the gingivae which were healthy did not exhibit inflammatory changes during pregnancy. THere was also a lesser number of healthy gingival sites during pregnancy than post partum. Hugoson (1971) attributed this finding to the Gingival Index system which he felt was not sufficiently sensitive to detect mild inflammation during the post partum period.

2.6.3 Studies to Determine the Cause of Gingival Changes

In a longitudinal study of over 100 pregnant women, Katz and his team examined the blood citrate levels during the third to the ninth month of pregnancy of the women (Katz, Shapiro, Gedalia, Zukerman 1969). The gingival and periodontal scores were significantly increased during pregnancy when compared with a control group, but there was no correlation between this increase and blood citrate levels. Their study was based on the findings of Tsunemitsu and Tanner (Tsunemitsu, Honjo, Kani, Matsumura 1964; Tanner 1967) who indicated that a hypercitricaemia occurred in those people suffering from active destructive periodontal disease.

O'Neil attempted to correlate gingival changes during pregnancy to immune changes that occur during the period (O'Neil 1979a). He found an exacerbation of gingivitis during pregnancy between the fourteenth and the thirtieth weeks of pregnancy. This did not occur in his control group of 30 women. A depression of cell mediated immune response was found during pregnancy, which suggested an altered responsiveness of the gingivae to plaque. However, he

could not demonstrate a significant difference between the parameters that he used to show a depressed immune response between his pregnant women and the control group of non-pregnant women.

O'Neil further investigated another possible cause for increased gingival inflammation in pregnancy (O'Neil 1979b). He tried to establish a relationship between increased levels of estrogens and progesterones, and increased gingival inflammation during pregnancy. Although oral hygiene instructions given to the pregnant women reduced their plaque scores during pregnancy, there was no corresponding reduction in inflammation. From these observations, O'Neil argued that it would have been more appropriate to compare the hormone levels between the fourteenth and the thirtieth weeks of gestation with the differences in the Gingival Index scores during the same period, rather than a direct comparison of recorded individual values for plaque, inflammation and hormone levels. By drawing scatter diagrams of his data, O'Neil showed that there was in fact no correlation between the increase in the hormone levels and the increase in gingival index scores.

Pack postulated that the gingival changes in pregnancy were due to an end-organ deficiency of folic acid (Pack, Thomson 1980). This was because it was suggested that folate metabolism may increase with an increase in sex hormones (Whitehead, Reyner, Lindenbaum 1973). In her study, 40 pregnant women were divided into three groups. One group received systemic folate, another, a folate mouthwash, while the third group served as a control. Pack and Thomson found that gingival inflammation increased between the fourth and the eighth month of pregnancy in all the women except for the group using the folate mouthwash.

In a further effort to determine whether the increase in gingival inflammation during pregnancy was due to some specific factor, Kornman and Loesche conducted a controlled longitudinal study on a group of pregnant women (Kornman, Loesche 1980). They focused their research on the gingival crevice microbial flora to determine if gestation induced any change in the crevice flora which affected gingival inflammation.

The increased gingival inflammation during pregnancy was indicated by the increase in the mean number of bleeding sites per patient between 13 to 28 weeks gestation. This was paralleled by increased serum levels of estradiol and progesterone, and also increased plaque levels of Bacteroides melaninogenicus ss. intermedius. As estradiol and progesterone have been shown to substitute for an essential growth factor, vitamin K, for this organism (Kornman 1982), Kornman and Loesche postulated that gingivitis in pregnancy could possibly be an opportunistic infection by Bacterioides intermedius due to favourable nutritional requirements in the gingival fluid.

2.6.4 Studies on the Gingival Status and Dental Behaviour of Pregnant Women

Chapman and his team examined the dental health status of a group of pregnant women who were attending routine antenatal visits in an Australian public hospital (Chapman, McDonald, Stoddart, Mackay 1971a; Chapman, McDonald, Stoddart, Mackay 1971b). They found that the oral health of the women was poor with a high prevalence of gingivitis and periodontitis. 72% of the women had inflammation of the gingivae while 85% of the group needed some form of dental treatment. Chapman stated that the most striking feature of his survey was the high need for urgent dental treatment.

Chapman and his team also found poor oral hygiene practices and irregular dental attendance in the women. When the women were questioned on their sources of dental knowledge, the majority reported that their chief source was from parents and less from schools or dentists. 86% of the women stated that they were willing to attend for dental treatment as part of their antenatal check up. This study by Chapman and his colleagues showed the importance of dental care and the willing participation by pregnant women for dental treatment, as part of their total programme for antenatal care. This offers great opportunity to target pregnant women as a willing and receptive group for dental health education.

A clinical survey was carried out by Lewis in 1964 on 684 pregnant women and 75 post natal women at a New South Wales public hospital in Australia (Lewis 1964). All the women had poor oral hygiene and many had neglected mouths with broken down teeth. Some of the pregnant women were examined more than once during their pregnancy. Of those who were, many showed an increase in gingival inflammation. Only 31 women, 4.5%, had completely normal gingiva on first examination using Russell's Periodontal Index. More than half the group of women had gingivitis. The incidence of gingivitis during pregnancy ranged from 35.2% in the 0 to 8 week group, to a peak of 61.7% in the 25 to 28 week group. There was a reduction to 49.1% in the 37 week group.

Toothbrushing habits were determined for all the women. It was found that although the majority of women claimed to brush their teeth once or more each day, the poor oral hygiene showed that very few carried out effective toothbrushing. Increased gingival inflammation during pregnancy was more prevalent amongst those who brushed their teeth less frequently. .This was evident in the Italian,

Maltese and Greek immigrant women who were in the habit of brushing only once a day, as compared with the Australian and New Zealand born women.

Lewis concluded from his study that the gingival inflammation during pregnancy was similar to that in non-pregnant women with a reduced incidence of inflammation before, during and after pregnancy in those women who brushed more frequently. He showed a higher incidence of gingivitis in pregnant women than in non-pregnant women. Lewis concluded that local factors were important as the cause of gingival inflammation while systemic disturbances arising probably from hormonal changes, were factors that influenced the increase in gingival inflammation during pregnancy.

In another Australian study, Fanning found 92% of pregnant women from a public hospital in Adelaide, needed treatment for gingival inflammation (Fanning, Barrett, Cellier 1966). Although the overall oral health was very poor, more than half the over 200 examined women felt that there was nothing wrong with their teeth. Only 32% of the women received regular dental care. Almost half of the pregnant women gave lack of interest in keeping teeth, as a reason for not visiting the dentist. 19% gave fear as a reason for not attending for dental treatment, while 18% felt it was too costly.

The study revealed poor oral health status and unfavourable attitudes towards preventive dental behaviour. Fanning advocated including dental examination as part of prenatal routine, because she felt that the poor dental attitudes would undoubtedly be passed on to the women's children unless some dental interventions were implemented. She felt that the prenatal clinic was the "best place for getting in touch with the family".

In Brisbane, Jago and his colleagues examined a group of pregnant women attending a maternity hospital (Jago, Chapman, Aitken, McEniery 1984). They found that only 16% were free of gingivitis, while 47% had gingival inflammation in at least half of the measured sextants. Jago found that 29% of the sample of pregnant women required oral hygiene instruction, while 67% needed oral hygiene instruction and prophylaxis. One woman needed advanced periodontal treatment. In a questionnaire survey of the women, he found that the women had poor oral hygiene habits, poor preventive dental behaviour and dental knowledge (Jago, Aitken, Chapman 1984).

When Jago compared his findings with those of Chapman in 1971 (Chapman, McDonald, Stoddart, Mackay 1971a, 1971b), he found little difference. In spite of a well developed oral health care system in Australia, Jago attributed this lack of improvement, in the oral health status and preventive behaviour of pregnant women, to the failure of basic health education and referral structure of the medical and maternal and child health centres. However, he was encouraged to find that 85% of the women wished to have dental examination included as part of their antenatal care.

In a study carried out by Doust and her team (Doust, Radalj, Wong-Lee, Phillips 1985), the oral health status of a group of pregnant women was found to be poor. 70% of the sample of 86 women required restorations, while over 60% showed obvious gingival inflammation in the first trimester of pregnancy. While a high proportion, 95%, reported brushing their teeth at least once a day, only 10% used interproximal cleaners.

Analysis of the self-reported behavioural data confirmed irregular and infrequent dental attendance, and ineffective home oral care. The study revealed that seeking dental care in pregnancy was a well defined social and cultural behaviour pattern of the group. The women also revealed that a dental clinic situated in a women's hospital was convenient. It also gave them confidence to attend for dental care during pregnancy.

2.6.5 Gingivitis and Periodontitis During Pregnancy

Studies have shown that pregnant women have poor periodontal health. Gingival inflammation has been shown to gradually increase during pregnancy with resolution following parturition (Loe, Silness 1963; Cohen, Friedman, Shapiro, Kyle 1969; Samant, Malik, Chabra, Devi 1976). The increase in severity of gingivitis was independent of any change in levels of plaque. Gingival inflammation reduced when there was effective plaque removal (Silness, Loe 1966) while healthy gingivae remained healthy throughout pregnancy with effective plaque control (Silness, Loe 1966).

The majority of studies on the gingival changes in pregnancy did not assess loss of periodontal attachment although pocket depths were measured. The increase in pocket depths during pregnancy were generally reported as being due to gingival oedema (Loe, Silness 1963; Hugoson 1971). With remission in gingival inflammation post-partum, pocket depths returned to original levels. However, workers acknowledged that without measuring attachment levels, the effect of pregnancy on periodontitis could not be determined.

It is interesting that Cohen's longitudinal study found some loss of periodontal attachment in his group of 16 pregnant women

(Cohen, Friedman, Shapiro, Kyle 1969). However, the attachment loss was reported as being not statistically significant 3 months post partum. With current knowledge that periodontal disease does not affect all teeth uniformly, it may be that in Cohen's method of analysis, the small number of women and the pooling of data obscured any observed changes in attachment loss. It would be interesting to determine the individual loss of attachment in those teeth with active destructive periodontitis during pregnancy.

Systemic changes in pregnancy are believed to cause these gingival changes. An increase in oestrogen and progesterone (O'Neil 1979b), or a decreased immune response (O'Neil 1979a) have been suggested. Folic acid deficiencies have also been postulated (Pack, Thomson 1980). None of these factors could be shown to cause the increased gingival reaction to plaque. A recent suggestion has been made by Kornman and Loesche that it is an opportunistic infection by specific bacteria Bacteroides intermedius, resulting from a favourable nutritional environment of increased oestradiol and progesterone in crevicular fluid (Kornman, Loesche 1980).

2.6.6 A Summary of Findings from Studies on Gingivitis During Pregnancy

1. There is a high prevalence of gingivitis in pregnant women.
2. There is an exacerbation of gingival inflammation during pregnancy.
3. The clinical presentation of gingival inflammation during pregnancy is more severe than the gingivitis caused by a similar level of plaque in the non-pregnant woman.

4. The increased gingivitis of pregnancy, reverts to its original level after parturition. There does not appear to be a significant change post-partum, to periodontal attachment levels, from the increased gingival inflammation.

5. Healthy gingivae remain healthy throughout pregnancy while gingivitis during pregnancy can be reversed with effective plaque removal.

6. Research suggests that conditions during pregnancy modify the inflammatory response of gingivae to dental plaque. There is also a suggestion that gingivitis in pregnancy may be a specific opportunistic infection superimposed on a pre-existing non-specific plaque induced gingivitis.

7. Both the dental profession and many women are aware of gingival inflammation during pregnancy.

8. Pregnant women perceive a need for dental examination during pregnancy.

9. Pregnancy is an opportune time for preventive dental intervention because of the perceived need of pregnant women for treatment.

10. The dental behaviour of pregnant women in the studies was poor although toothbrushing was a common practice with interproximal cleaning being practised by only a few.

2.7 THE SIGNIFICANCE TO THE COMMUNITY OF GINGIVITIS DURING PREGNANCY

The common occurrence of gingivitis during pregnancy is of community significance because:-

1. It is a condition recognised by the dental profession and by pregnant women as needing intervention.

2. It reflects the widespread presence of gingivitis in the community.

3. It shows that toothbrushing practice in the general community is not effective enough in preventing gingivitis.

Although gingivitis during pregnancy reverts to its original level without significant loss of periodontal attachment following parturition (Cohen, Friedman, Shapiro, Kyle 1969), the exacerbation of gingival inflammation during pregnancy, presents an opportunity to meet needs for periodontal intervention. This intervention can be developed as a planned preventive periodontal programme to improve the effectiveness of toothcleansing and to promote preventive dental behaviour in the community. Effective oral cleansing and regular dental attendance will improve oral cleanliness and allow early detection and treatment of periodontal diseases. This would constitute an effective method of preventive periodontal intervention in the community.

3. PREVENTIVE PERIODONTICS

3.1 MAINTAINING A FUNCTIONAL DENTITION FOR LIFE

3.1.1 Introduction

The World Health Organisation has stated one of its goals for oral health in the year 2000, as being the maintenance of a functional dentition for life. In measurable terms, the aim is to have 85% of the population retaining all their permanent teeth at age 18 years, 75% of people aged 35 to 44 years and 50% of those aged 65 years and over, having a minimum of 20 functional teeth (Barmes 1983). It is known that periodontal disease is one of two major causes of loss of teeth in an individual's life. Unfortunately, at present, the only preventive measure for periodontal diseases is regular and effective removal of dental plaque (FDI 1984).

While primary prevention of periodontal diseases through dental health education, constitutes the most valuable form of preventive measure, the long term effectiveness of dental health education programmes in the community has not been clearly established. Apart from education, early detection and treatment of periodontal diseases are also important to maintaining a functional dentition for life. Therefore, the community must practise effective oral hygiene and attend for regular professional care, in order to prevent periodontal diseases.

3.1.2 Traditional Dental Care

Although regular professional care is widely recommended for oral health, there is little evidence that traditional dental care prevents periodontal disease in the population (Lux 1982).

Traditional dental care may be characterised by a technologically orientated approach to treatment and attempted cure rather than prevention (Sheiham 1984b).

According to Martin and Mauldin, traditional six monthly checks and prophylaxis do not fully meet the needs of dental patients (Martin, Mauldin 1983). Suomi and his co-workers found no improvement of periodontal health when scaling was carried out three times a year (Suomi, Smith, Chang, Barbano 1973). Similarly, Lightner found no clinically significant difference in the gingival condition between persons having two or four preventive treatments a year (Lightner, Crump, O'Leary, Drake, Jividen 1968).

Nyman established that there was an obvious risk of recurrence of periodontitis in those patients who were recalled for prophylaxis at six to twelve month intervals (Nyman, Rosling, Lindhe 1975). Axelsson and Lindhe showed progressive loss of periodontal attachment in a group of patients who received traditional dental care consisting of only symptomatic treatment (Axelsson, Lindhe 1981a). According to these two workers, the failure of traditional dental care to prevent periodontal diseases is because it is directed towards the elimination of symptoms of periodontal disease rather than the elimination of the cause. Sheiham maintained that unless an individual was able to keep up a reasonable level of oral cleanliness by regular and consistent home care, the benefits of any treatment by dental professionals would be limited (Sheiham 1984b).

3.1.3 Application of Theory to Practice

Axelsson and Lindhe have reported that professional prophylaxis at intervals of 2 weeks to 2 months, prevents gingivitis in children (Axelsson, Lindhe 1977). Similarly, professional cleaning at 2 to 3 month intervals, supplemented by home oral care, can maintain good periodontal health in adults (Axelsson, Lindhe 1981a). According to Sheiham, this form of prevention is expensive at the community level (Sheiham 1983). Burt, however, proposed to overcome this cost restraint by the greater effective use of auxiliaries (Burt, Warner 1983).

Today, although there is sufficient knowledge to prevent most forms of periodontal diseases, the problem of prevention lies in the difficulty of applying available scientific knowledge to the implementation of effective preventive programmes. Silversin and Kornacki have stated that a wide gap exists between the available measures for control of periodontal diseases and their full and appropriate application (Silversin, Kornacki 1984a). As such, even though there is conclusive evidence that regular effective plaque removal will prevent periodontal diseases, this all important measure has not been fully exploited and fully taken advantage of, by most oral health preventive programmes (Pilot 1984).

It has been shown that preventive dental behaviour is strongly associated with income and educational level. Individuals with a higher income and those with a higher educational level are more likely to practise prevention (Chen, Stone 1983). Thus programmes for preventive periodontal intervention will be facilitated by improvements in the socio-economic and educational status of individuals in the community.

The general public, on the whole, has not been made aware of this simple and effective preventive measure. To this end however, dentistry has shifted from the early practice of just initiating a brief mention of dental plaque, and its significance in the prevention of periodontal disease, to people, at the time of a short dental examination. Until the 1970's, a session of simple oral hygiene instruction was taken to constitute an adequate preventive measure for the majority of regular dental attenders. Since then, studies have shown that this represents an over-simplification of the true position for the effective control of periodontal disease (Silversin, Kornacki 1984b).

It is now considered that a much more in-depth process is needed to motivate people to practise effective and regular oral cleansing (Nikias, Budner, Glassman, Turgeon 1980). This emphasis is further taken by various special health education measures, practised by the dental profession, as an intensive and specialist area in the prevention of periodontal diseases. Stress is placed on behavioural science and motivation of people in preventive programmes (Bakdash 1979; Weinstein 1982). This is because the role of individual behaviour is much more dominant in the control of perio-dontal diseases than it is with caries. Preventive activities like dental health education programmes are therefore important for the development of greater consciousness towards periodontally beneficial patterns of personal behaviour.

3.2 THE LACK OF ATTENTION TO PREVENTIVE PERIODONTICS

Preventive periodontics is practised by few dentists (Sheiham 1984b; Croxson 1984). From the time that dentistry became organised, the teaching institutions, the dental profession and the community, have been orientated towards treatment and repair. The dentist feels insecure and guilty, and the patient feels cheated, if a dental visit does not result in a filling, a denture, or minus a tooth. This has stemmed from attitudes of the tradition of dentistry. Dental treatment has, from the time of the "toothdrawers", often limited its scope to medical and physical measures (Hoffmann-Axthelm 1981). The profession was developed as a craft to repair teeth broken through trauma or through the excessive wear from coarse foods. Any attention given to periodontal conditions was directed as a medical measure because of the lack of knowledge of the disease condition (Hoffmann-Axthelm 1981). According to Allen, the treatment of dental caries and its sequelae had traditionally been the theme of dental education. He felt that preventive dentistry and periodontics needed greater attention in the educational programme for many schools (Allen 1985).

There is also a belief by the profession, that individuals will not accept prevention readily, or pay for it. There is too much evidence of non-compliance by people towards preventive dental measures (Rayant, Sheiham 1980). In modern times, the dentist has been too busy with repair (Bawden 1981). Caries had developed to become a major cause of tooth loss in developed societies. Therefore, there has been little time to practise prevention (Croxson 1984). Tradition and change in practice is difficult. Moreover, popular conceptions of dentistry associate it more with cosmetics than with

health. Thus the reparative treatment philosophy has emerged under the influence of traditional patient expectations. Thus, technically proficient restorative dentistry had become the dominant professional "ideal" that governed the content and goals of dental education and professional policy.

Although toothbrushing is a social norm in many societies, effective and regular oral hygiene measures are not adequate. This may be related to a lack of awareness by the public of the importance of oral cleansing in relation to periodontal disease (Brown 1983). On the other hand, awareness may not lead to regular oral care because of the low value people place on teeth (Sheiham 1984a). Surveyed adults in New Zealand, showed low levels of awareness of periodontal disease (Croxson 1984), while even in developed countries with an adequate dental workforce, many people neither practise effective oral hygiene nor seek regular oral health care (Cutress 1984).

The factors that affect an individual's lifestyle and determine the adoption of appropriate oral health behaviour, have been attributed to psychosocial factors. To accelerate improvements in periodontal health requires an increase in public acceptance of preventive periodontics and the development of positive attitudes towards general preventive health behaviour. Sheiham believes that this must be approached on a population basis to be effective (Sheiham 1984a). According to Sheiham's view of the British population, this poses a considerable challenge because of the lack of value people place on a healthy dentition as part of good general health (Sheiham 1984a). Another reason is the nature of the disease, with generally low levels of discomfort and the almost universal symptom of bleeding gums. This has led to the public's low perception

of the need for care (Croxson 1984).

3.3 LEVELS OF PREVENTION

3.3.1 Introduction

Preventive measures aimed at controlling and preventing gingivitis and periodontitis, should be applied at levels of primary, secondary and tertiary prevention (WHO 1978). The various aspects of periodontal disease prevention are thus aimed at preventing and halting the progression of the disease, with the former taking precedence over the latter. These can be organised according to the extent to which the activity alters favourably, the natural course of the disease. Thus primary prevention aims at the pre-pathogenesis phase of the diseases, secondary prevention aims at early treatment to prevent progression, while tertiary prevention involves treatment directed at controlling established disease (WHO 1978).

Primary, secondary and tertiary levels of prevention of periodontal diseases have been proposed by Grant, Stern and Everett (Grant, Stern, Everett 1979). These are set out in a modified form in Table 1 (page 42).

3.3.2 Primary Prevention

Primary prevention of periodontal diseases involves the promotion of periodontal health through improvements in oral hygiene. It also includes regular dental attendance for early detection of disease, removal of factors such as poor restorations that tend to retain plaque, correction of abnormal habits and gross occlusal disharmonies. This is the prepathogenesis period of preventive intervention.

Table 1: Levels of prevention of periodontal diseases

Primary prevention (prepathogenesis)

Health promotion

Health education

Patient motivation

Periodic oral examination

Oral hygiene instruction

Adequate nutrition

Diet planning

Healthy living conditions

Specific protection

Periodic prophylaxis, plaque control training

Effective oral hygiene and interproximal cleaning

Correction of poor restorations

Correction of abnormal habits

Correction of gross occlusal disharmonies

Secondary prevention

Early diagnosis and prompt treatment

Periodic X-ray examination

Regular oral examination, prophylaxis and health education

Prompt treatment of periodontal lesions

Treatment of other oral lesions contributory to periodontal lesions

Disability limitation

Treatment of periodontal abscesses

Root planing

Minor surgical interventions

Extraction of teeth with poor prognosis

Tertiary prevention

Rehabilitation

Treatment of established disease with root planing and/or surgery

Replacement of lost teeth for aesthetics or function

Periodontal prosthesis

Splinting

Psychotherapy when indicated

(Modified from: Grant, Stern, Everett 1979)

For primary prevention to be effective, the individual has to initiate the process. Thus periodontal health is strongly dependent upon personal behaviour. The prevention of periodontal diseases at the primary level, therefore rests with the problem of how best to motivate individuals to adopt an appropriate oral health care behaviour throughout life and to attend for regular dental examination. A positive approach often suggested is to help individuals to develop the feeling of clean teeth and gingivae. Unfortunately, this approach failed to maintain optimum oral hygiene levels even after several years of supervised toothbrushing (Lindhe, Koch 1967).

A major obstacle in the primary prevention of periodontal diseases lies in the lack of obvious symptoms of early disease. The majority of individuals are unaware that gingival bleeding is an early sign of the disease. In fact, because of the widespread nature of this symptom, many individuals regard it as a norm (Ainamo 1984). Furthermore, even when individuals view it as disease, they tend to approach it in terms of their understanding of bodily bleeding, which is, that the area of bleeding should be given rest to allow healing. Moreover, individuals often associate gingival bleeding with over vigorous brushing. In view of such concepts, areas of the gingivae that bleed tend to be avoided during toothbrushing (Ainamo, Ainamo 1981). From these observations, it is obvious that a programme for primary prevention of periodontal diseases must be determined according to cultural beliefs and practices, with the objective of increasing knowledge and understanding of the disease and developing oral hygiene skills. This can be supported by general health promotion involving diet, nutrition and healthy living conditions.

Since social and educational variables influence oral hygiene behaviour, socialisation is important to the acquisition of knowledge, values, attitudes and routines (WHO 1979). Targeting primary prevention programmes on expectant mothers would benefit the primary socialisation of the next generation.

Expectant mothers have been found to perceive a need for dental examination during pregnancy (Doust, Radalj, Wong-Lee, Phillips 1985). Many expectant mothers also experience gingival bleeding which becomes worse as pregnancy progresses. Primary prevention of periodontal disease is therefore appropriate during antenatal routine examination because of the benefits to both the mother and her new baby.

Studies have shown a high level of compliance in pregnant women to dental health education (McKegg 1984). Furthermore, mothers have been reported to be the major influence on toothbrushing behaviour of their children (Blinkhorn 1980). In this way, by targeting primary prevention on expectant mothers, exacerbation of gingivitis can be prevented during pregnancy, and appropriate oral hygiene behaviour can be spread to the family and future generations. This would facilitate a community strategy for preventive periodontal intervention.

3.3.3 Secondary Prevention

Secondary prevention of periodontal diseases involves treatment of early disease in order to prevent their progression. Early diagnosis and treatment of incipient disease will ensure a better control of its progression. The dental profession must therefore take advantage of advances in the understanding of the aetiology and pathogenesis of periodontal diseases, in concepts of

plaque control and the maintenance of periodontal health. There must be a greater awareness and recognition of the conditions when examining a patient.

Success with secondary prevention lies with the general practice of dentistry. Early diagnosis and a meticulous prophylaxis of the teeth must be accompanied by effective dental health education (Axelsson, Lindhe 1981a). There is strong evidence that regular scaling combined with oral hygiene instructions will result in improved periodontal health (Ainamo 1984). There must be prompt treatment of lesions with prophylaxis, root planing and surgery if necessary, and extraction of teeth having poor prognosis. The dentist must adopt a positive examination procedure which recognises the presence of disease and the need for treatment. The importance of the role of the general practitioner dentist in secondary prevention cannot be over-emphasised. This is because screening and monitoring patients for periodontal diseases must be carried out at the general practitioner level. Croxson advocated the use of the Community Periodontal Index of Treatment Needs (CPITN), developed by the Oral Health Unit of the World Health Organisation, as an easy and rapid way of screening and monitoring periodontal diseases in general practice (Croxson 1984).

3.3.4 Tertiary Prevention

Tertiary prevention involves treatment directed at controlling established periodontal disease, preventing their progression, preventing subsequent complications, and providing prostheses to restore function and appearance where necessary (Ewart, Harvey, Neels 1983). Root planing or surgery may be required, with splinting of loose teeth if necessary. Where there has been either

ignorance or neglect of oral health, and disease is at an advanced stage, tertiary prevention can prevent loss of teeth.

While the actual treatment techniques have changed and varied according to the differing concepts and understanding of the diseases, the basic aim has always been to clean the tooth surfaces, remove diseased tissues and restore health and function. Plaque free tooth surfaces have always been central to the whole approach, and maintenance care by both the professional and the individual forms an integral part of the whole preventive programme (Axelsson, Lindhe 1981b). It has been demonstrated that if there is established gingivitis or periodontitis, meticulous professional treatment supported by effective personal oral hygiene care, will control the diseases (Knowles, Burgett, Nissle 1979).

3.4 PREVENTIVE MEASURES FOR CONTROLLING PERIODONTAL DISEASES

3.4.1 Introduction

Although it is now well established that gingivitis and periodontitis are caused by bacteria, it is also believed that regardless of the relative importance of various micro-organisms in the pathogenesis of these diseases, the regular effective removal of dental plaque prevents and controls the initiation and progress of periodontal diseases (Burt 1984).

Where the host response is insufficient to cope with the persistent or virulent bacterial onslaught from plaque, destructive disease will occur. On the other hand, gingivitis may reflect a very adequate host response. With the present state of knowledge where the possibility of affecting host response is limited, it would seem that the only practical way of preventing periodontal diseases

is by the careful control of plaque.

3.4.2 Individual Mechanical Cleansing

The most practical method of plaque control is by their physical removal through the application of frictional cleaning. The toothbrush most commonly recommended by the dental profession appears to be a four-row multi-tufted flat-trimmed soft nylon hand brush, with children using a smaller brush than adults (Schmid 1981; FDI 1984). Horowitz reported that the type of toothbrush used was unimportant (Horowitz 1980) but generally, nylon rather than natural bristle brushes are advocated because of the uniformity of size and homogeneity of the nylon material. Nylon filaments also resist fracture and are able to repel water and debris (Schmid 1981). There is no clear evidence on the superiority of any particular filament hardness, size and number, although multi-tufted brush configurations are usually recommended.

The handles of toothbrushes also vary in size, colour and shape for marketing appeal to the different tastes of individuals. Unlike the claims to superior plaque removal by manufacturers for filament quality and brush configurations there have been few claims to any superior brush handle design. Recently, the "angled" toothbrush with the handle set at 17° to the brush head has been shown to clean the lingual areas of posterior teeth better than a conventional brush (Schmid 1981).

In attempting to improve the effectiveness of toothbrushing, electrically powered brushes were developed in 1939 (Schmid 1981). To date, these brushes are no more effective than manual brushes except when used by handicapped persons with limited manual dexterity (FDI 1984). This is because brushing strokes of electric tooth-

brushes are automatic, and are therefore an advantage with the mentally or physically disabled.

Almost every conceivable brushing stroke has been advocated over the years. In the different methods of tooth brushing, no method has been found to be clearly superior one from another (FDI 1984). This is due in part to the difficulties of assessing such studies and to the great variations in individual manual dexterity. However, the scrub technique appears to be the easiest and the most popular method of tooth brushing (Schmid 1981) because it requires minimal manual dexterity and patient concentration (FDI 1984).

To enhance the cleansing effect of toothbrushing, dentifrices are encouraged because of their detergent and abrasive components. Dentifrices are also used as vehicles for chemotherapeutic agents such as antiseptics for their action against bacteria (Schmid 1981). Other aids to cleansing are interdental cleaners like dental floss, interproximal brushes, wooden toothpicks and rubber or plastic tips (Schmid 1981). These are used in cleaning the all important interproximal areas of the teeth which are inaccessible to the toothbrush.

Other oral cleansing aids include plaque disclosants which identify for the individual, plaque, leading to their effective removal (Melcer, Feldman 1979). Oral irrigators have also been promoted as aids to oral cleansing. These are useful for the removal of oral debris only, and do not remove plaque to any significant degree (Fine, Bauhammers 1970).

Oral hygiene aids are important to effective plaque control. This is especially so for interproximal cleaning because non compliance with flossing has been associated with the lack of skill in using the dental floss (Boyer, Nikias 1983). Aids like floss

holders are thus important in facilitating floss manipulation (Jerman, Christen 1981).

3.4.3 The Difficulties with Individual Mechanical Cleansing

Although mechanical tooth cleansing dates back thousands of years, plaque removal by man today is still far from adequate (Schmid 1981). A study by De la Rosa has shown that with an average 2 minute cleansing every day, 60% of plaque is left behind on teeth (De la Rosa, Guerra, Johnston, Radike 1979). The proportion of the mouth brushed by young persons aged 5 to 22 years, in another study, was found to be only 25 to 67% (Rugg-Gunn, MacGregor 1978).

It has also been said that complete plaque removal by the individual on a daily basis is difficult to achieve (Ainamo 1984). This notwithstanding, the effectiveness of tooth cleansing is still the most important aspect of disease prevention and maintenance of periodontal health. Therefore, the most practical objective is to instruct and encourage individuals to maintain a level of oral hygiene where there is minimal plaque, where the emphasis should be on the effective removal of plaque rather than the number of times of brushing in a day (Ainamo 1984). Based on the study of Lang, Cumming and Loe (Lang, Cumming, Loe 1973) that plaque removal every 24-48 hours maintained periodontal health, Burt has recommended a thorough oral cleansing once every 24 hours (Burt 1984). For effective oral cleansing, the duration of toothbrushing was more important than the frequency of brushing (Honkala, Nyyssönen, Knuuttila, Markkanen 1986).

When properly used, the toothbrush and oral cleansing aids have been shown to be effective in controlling plaque. Studies have demonstrated improvements in oral hygiene following instructions in

home oral care (Lindhe, Koch 1966). Although plaque control programmes show good promise in the short term, long term success has often been poor (Frazier 1978). The limited long term success of plaque control programmes is attributed to inappropriate life-styles rather than a deficiency in oral cleansing skills alone (Pilot 1984).

The difficulty of achieving compliance in dental preventive behaviour is well known. Reasons for non compliance are many. Dworkin, Ference and Giddon have suggested that the health belief model of Rosenstock (Rosenstock 1974) may apply, where individuals will only comply with preventive advice if they believe themselves to be susceptible to dental disease, that the disease is serious and that prevention is to be desired rather than treatment (Dworkin, Ference, Giddon 1978).

Other reaons for non compliance could be the complexity of the required action. For instance, Wolffe reported that flossing was difficult when he found that in a group of subjects only 50% of proximal plaque was removed using the floss (Wolffe 1976). Boyer and Nikias further found that this difficulty with flossing led to non compliance (Boyer, Nikias 1983). In an effort to overcome these difficulties, many periodontists advocate the use of the floss holder for individuals with poor manual dexterity (Jerman, Christen 1981).

3.4.4 Chemical Plaque Control

In view of the efforts and competency required by most individuals to achieve regular and conscientious plaque removal, any agent that will control plaque by a less demanding method with lesser individual efforts, will have great potential. Unfortunately,

there is no equivalent to water fluoridation or other community-based uses of fluoride to prevent periodontal diseases (FDI 1984). In an attempt to find such an equivalent, there are therefore obvious advantages when agents such as anti-microbials carried in mouthwashes or dentifrices can be used to aid plaque control. To date however, these are only temporary and minimal measures with limited application.

Mouthrinsing, when compared with toothbrushing, demands little skill and requires less time and effort in terms of individual compliance. Many chemicals have thus been investigated for their effects on plaque. Such chemicals include the peroxides, phenol compounds, fluorides, iodides, ammonium compounds and the biguanides, of which Chlorhexidine shows some promise (Frandsen 1981).

At present there are no completely effective chemicals for long term control of dental plaque, although Chlorhexidine gluconate has been reported to be of potential value (Loe, Schiott 1970). In a controlled study of a commercial antiseptic mouthwash, Lamster found a 50% reduction in plaque (Lamster, Alfano, Seiger, Gordon 1983). Thus, chemical control of plaque supported by mechanical cleansing, offers great advantages for individuals who are unable to carry out effective home oral care (American Dental Association 1986). Mouthwashes can thus be of great value as adjuncts to mechanical methods of plaque control (American Dental Association 1984; FDI 1984). However, if chemicals are to be used as antiseptics against oral bacteria, it would appear that most chemicals would need to be used throughout life in conjunction with mechanical cleansing.

The disadvantages of unpleasant taste, stained teeth and restorations, are important negative aspects to be taken into consideration in the use of antiseptic mouthwashes, such as Chlor-

hexidine and Alexidine, as a plaque control aid in the community. The unacceptable cosmetic and aesthetic effect as well as the highly unpleasant taste, may far outweight the oral health advantage of using these mouthwashes. However, if such disadvantages can be overcome, mouthrinsing may have greater potential than mechanical oral cleansing.

The promotion of mouthrinsing can be approached on a social basis of freshening breath rather than an appeal to oral health. This can be reinforced by mass media advertising which appeal to individuals to use mouthwashes as an oral deodorant, for "fresh breath", with the emphasis on a cosmetic rather than a health reason.

According to Sheiham, toothbrushing is often associated with grooming behaviour (Sheiham 1984b). Therefore, mouthwashes can also be similarly promoted in the community. This can be achieved if commercial interests can be effectively harnessed to support and reinforce appropriate patterns of behaviour for periodontal health. For instance, commercial firms can be encouraged in their profit-orientated self interest, to advertise and promote oral cleansing products based on commercial marketing research tactics or schemes, rather than health promotion strategies.

Antibiotics have been shown to suppress plaque formation and reduce gingivitis to various degrees. These include broad spectrum antibiotics like tetracycline and kanamycin, as well as those of a narrower spectrum such as penicillin, erythromycin and spiramycin, some antibiotics like vancomycin and niddamycin (CC10232), act specifically against Gram positive organisms, while others like polymyxin act against Gram negative bacteria (Parsons 1974). These

can be used to support conventional pocket therapy and should be viewed as therapeutic modalities to be used as adjuncts to conventional treatment. Administration may be systemic or local as in the use of tetracycline-filled hollow fibre tubings (Goodson, Haffajee, Socransky 1979).

Another chemical, metronidazole has also been used in the treatment of periodontal lesions like abscesses where obligate anaerobes may be the predominant pathogens. Side effects like development of resistant strains, hypersensitivity and superinfection are dangers in the indiscriminate use of antibiotics and metronidazole. For these reasons, the daily or constant use of these chemicals cannot be recommended.

Chemical plaque control with antiseptics or antibiotics thus aims at reducing the pathogenicity of dental plaque. However, it is not known how much plaque has to be present to initiate disease and how much must be suppressed to prevent disease. The key question is, which plaque is pathogenic for which individual (American Dental Association 1986). Therefore chemical agents that simply reduce gross plaque levels, are not necessarily useful in preventing periodontal diseases. Instead, anti-plaque agents must be effective in reducing gingival inflammation on both a short and long term basis.

3.5 SUCCESSFUL PREVENTIVE PERIODONTICS

The goal of maintaining a functional dentition for life can be achieved with preventive periodontics. This is brought about through the following measures:-

1. Regular professional examination and dental prophylaxis at 2 to 3 month intervals.

2. Early detection and treatment of periodontal diseases.
3. Consistent effective personal oral hygiene care using the toothbrush and interproximal cleaners supplemented by oral hygiene aids such as dentifrices, mouthwashes and disclosants.
4. Promoting greater awareness of periodontal diseases through education of the profession and individuals in the community.
5. Removing the psychosocial and economic obstacles to effective oral health care through educational and social interventions.

4. DENTAL HEALTH EDUCATION IN PREVENTIVE PERIODONTICS

4.1 THE CONCEPT OF DENTAL HEALTH EDUCATION

Dental health education may be described as a process which helps individuals make voluntary adaptations of behaviour conducive to good oral health. Since dental health education is an integral part of general health education, its definition must lie within the concepts of health education. Striffler has stated that dental health education is but one example of health education in general and it is therefore useful to define the latter term (Striffler, Young, Burt 1983).

Health education has been variously defined because it has a different connotation for different people. It becomes more complex the more carefully it is examined. As defined by 7 health organisations in the United States (Striffler, Young, Burt 1983), health education is "a process with intellectual, psychological and social dimensions relating to activities which increase the abilities of people to make informed decisions affecting their personal, family and community well-being. This process, based on scientific principles, facilitates learning and behaviour change in both health personnel and consumers, including children and youth". This view of health education focuses on the importance of psychosocial and cultural aspects of health behaviour, and on the roles played by the individual, the professional and the community.

4.2 FACTORS AFFECTING DENTAL HEALTH EDUCATION

The ultimate goal of planned dental health education programmes is a modification of old behaviour or the adoption of a new target behaviour that will promote and improve individual,

group and community health. Programmes for dental health education must therefore identify factors within the individual or community which will affect behaviour. These include beliefs, attitudes, interests, values, needs, motives, expectations and perceptions.

The Health Belief Model of Rosenstock (Rosenstock 1974) holds that individuals will adopt a preventive behaviour if three conditions are met. The individuals must feel susceptible to the disease. The disease must be severe enough to interfere with some aspect of their lives. The benefits of taking preventive action must outweigh the psychological and economic costs that are involved. In recent times, research indicates that in addition to the factors in the Health Belief Model, there are socio-economic environmental factors affecting behaviour (Rayant, Sheiham 1980).

Today, most individuals are aware that they are susceptible to oral diseases, but few regard this as a serious problem. Because oral diseases do not seem serious to most people, actions to alleviate the problem are not given high priority even though it is acknowledged that prevention is possible (WHO 1978). It has further been stated that it is not possible to teach that which a learner does not view as worth knowing (Striffler, Young, Burt 1983).

Factors in the environment will interact to affect individual behaviour. These external factors may involve the family, peer groups, friends, health facilities and services. Studies indicate that only if there is a positive change in public attitudes towards preventive health behaviour, can a potentially effective preventive periodontal or oral health programme be successful (WHO 1978).

The individual approach by the dentist to effect behavioural changes in individuals has limited success and is highly expensive at the community level (Sheiham 1983). Sheiham has therefore proposed

a population strategy for preventive periodontal programmes involving general health education with a diverse educational approach and community participation in planning and implementation (Sheiham 1984b).

Health education programmes must therefore continually change to suit the changing personal and situational factors. Many of these factors act positively for pregnant women. For instance, many women and health professionals feel that pregnancy is a time when dental care should be sought (De Liefde 1984). No matter what the reasons for this need may be, the important fact lies in the decision and the action taken by this group to seek dental care.

4.3 THE EFFECTIVENESS OF DENTAL HEALTH EDUCATION DURING PREGNANCY

4.3.1 A One-Visit One-to-One Approach

In attempting to determine the effect of improved oral hygiene on gingivitis during pregnancy, Silness and Loe found that there was a general reduction of oral debris following a one visit instruction in oral hygiene (Silness, Loe 1966). The group of pregnant women in the study, belonged to the lower socio-economic strata of society. Notwithstanding the fact that lower socio-economic strata individuals are less receptive to preventive advice, and that a one visit oral hygiene programme has limited effectiveness (Evans 1978), Silness and Loe found an improvement in the oral hygiene status of the women between the first trimester when oral hygiene instructions were provided and the third trimester. This was demonstrated by the absence of gingival inflammation in areas that were free of plaque.

This study was aimed primarily at gaining more information on the relative importance of oral debris as a cause of gingivitis during pregnancy, rather than determining the effectiveness of oral health instructions during pregnancy. Nevertheless, it may be observed that even a one visit oral hygiene session yielded valuable results in the pregnant women.

4.3.2 A Planned Programme Using Dental Health Educators

In a controlled trial of a dental health education programme on pregnant women, McKegg used lay health educators to modify the behaviour of these women in their first pregnancy (McKegg 1984). Educators were carefully selected from among the community where the pregnant women lived. These educators, most of whom were mothers and grandmothers, were provided with a six week training in interview and counselling methods, hospital routine and office systems, and in preventive home care and recording procedures. This enabled them to help pregnant women to evaluate their own efforts at home oral care.

The aim of the programme was to use educators who were culturally acceptable to the pregnant women, and who would be able to help the women, using objective and measurable ways of determining tooth cleanliness, to adopt effective oral hygiene habits at home. Pregnant women attending an antenatal clinic were examined and given a scaling with oral hygiene instructions by a dentist. At the following antenatal visit, a teaching session was carried out with a health educator personally helping one to three women at a time, develop oral cleansing skills. Each woman was provided with a tooth-brush, dental floss, liquid erythrosine, a plastic mouth mirror and an explanatory pamphlet.

The teaching sessions involved active participation by the women in oral cleansing procedures and use of disclosants for feedback. When the educator was satisfied with the skills acquired, the session ended. Follow-up home visits were made by the educator at 6 weekly intervals over the following 12 months. These visits provided feedback and reinforcement on the effectiveness of oral cleansing by the women.

The study found that there was a high compliance in the group of pregnant women with a significant improvement in oral hygiene compared with a control group who received no interventions. The improved oral hygiene of the test group of women was maintained at 12 months after the start of the programme, with a further improvement at 18 months. This showed that the programme continued to exert an influence beyond the withdrawal of the home visits at the 12 month stage (McKegg 1984).

This study demonstrated that specially selected lay educators can be specifically trained for their tasks at minimal cost. The study further showed that educational programmes can be tailored to the needs of a group with close personal instruction and regular reinforcement, and be highly effective. McKegg concluded that primiparous women form an important target group for successful dental preventive intervention.

4.3.3 A Dentist-Centred Programme

In another study carried out on pregnant women attending an antenatal clinic in a women's hospital in Western Australia, it was found that pregnancy was an ideal time to implement preventive programmes. The programme was carried out essentially by a dentist who was the team leader. Scaling was done by a dental therapist but

dental health education, based on a behavioural approach, was carried out by the dentist herself (Doust, Radalj, Wong-Lee, Phillips 1985).

There were 30 pregnant women in the study group and 33 pregnant women in the control group. There were no differences between the two groups in terms of base-line assessments of plaque, gingivitis and calculus during the first examination at the end of the first trimester. There were also no differences between the two groups for attitudes, knowledge and beliefs, oral health behaviours, and social and demographic variables as determined by a pre-test questionnaire. The study group was given a thorough scaling by a dental therapist. A toothbrush, toothpaste, dental floss, disclosing liquid, a plastic mouth mirror and an explanatory pamphlet were given to each woman. Intensive skill training involving active participation was a major component of the education process conducted by the dentist. These took place over 3 to 4 visits scheduled in the second trimester. The control group received traditional dental treatment for their gingivitis. This consisted of a session of scaling with brief instruction on toothbrushing and flossing or use of woodpoints.

At the post-test assessment in the third trimester, the study group showed statistically significant reductions in mean plaque and gingival scores compared with their initial assessments. This did not happen with the control group who instead, showed an increase in gingival scores at the post-test examination carried out between 33 to 35 weeks' period of pregnancy. There was also a positive favourable change in the attitudes and self-reported behaviour of the women in the test group but not in the control group.

The results of this study indicate that a combined programme of scaling and patient education in a specially selected dentist/auxiliary clinic setting, can have a successful outcome. In terms of the short term goal of improved oral health behaviour, as evidenced by the absence of increased gingival inflammation during pregnancy, this study is being followed through to determine whether the longer term goal of improved oral health in the children of the study group, would be achieved.

4.3.4 A Summary of the Reported Studies

Compliance in oral hygiene instruction was high in the 3 reported studies of dental health education directed at pregnant women. The studies also demonstrated that:-

1. A one-to-one approach is an effective method of providing dental health education.
2. Dental health education can be provided by either a dentist or a specially selected lay person who is acceptable within a community and trained specifically to deliver dental health education.
3. All the studies reported here, had scaling to remove calculus prior to education of the women in oral health cleansing.
4. The improved oral cleansing was detected between the first trimester of pregnancy when the preventive intervention was given, and the third trimester. One study reported compliance at the final assessment, 18 months after the start of the preventive intervention. There were no reinforcing interventions 6 months prior to this final assessment.
5. Reinforcements of oral hygiene instructions were carried out in 2 of the 3 studies reported here. In the dentist-centred

programme, 3 to 4 education sessions were made within the second trimester of pregnancy. In the programme using health educators, 6 weekly visits were made over a period of 12 months following the initial teaching session.

These 3 studies have demonstrated that dental health education can achieve effective compliance over a period of several months to 18 months, if aimed at the right group, at the right time. This demonstrates that the targeting of dental health education at pregnant women can be an effective strategy for improving oral cleansing.

4.4 DENTAL HEALTH EDUCATION FOR THE COMMUNITY

4.4.1 Developing Strategies

There is a need for effective strategies in dental health education because dental health education programmes have been criticised for their lack of success in changing behaviours (Frazier 1978). Frazier has stated that educational programmes alone have not been effective in instilling permanent desirable habits of oral hygiene; whatever behavioural practices are fostered tend to regress over time.

Selecting an appropriate group for educational intervention is important. Burt suggests that adolescents may be a more mature age group for such intervention rather than primary schoolchildren (Burt 1983). The limited success of many dental health programmes may be due to the inappropriate targeting of the intervention on young primary schoolchildren. Seemingly appropriate education methods may not be appropriate to this immature age group.

Pregnant women would also be an appropriate group for dental health intervention. This is because this group in the community has been shown to be highly receptive to dental health education (McKegg 1984).

Integrating dental health education within general health education may be a better strategy than delivering the former in isolation. Dental health education programmes for schoolchildren have been criticised by Sheiham for their isolated method of delivery in schools. This educational approach may prove more successful if it forms a part of comprehensive health education programmes in schools (Sheiham 1983).

Other methods of improving the outcome of dental health education have been suggested. These aim to optimise salience, habit formation, longer term change and concomitant reinforcement. Emphasis should be directed towards the imitation of "significant others", like mothers and teachers. Methods should include community involvement, changing attitudes by showing inconsistencies in currently held values, attitudes or behaviour, and gaining the attention and support of the mass media (Rayner, Cohen 1974). While parental involvement has been urged for the formalised oral hygiene programmes for children (Holt, Winter, Fox 1985), Sheiham has advocated greater exploitation of informal health education within the family (Sheiham 1983).

4.4.2 Targeting the Strategies

Methods for dental health education in the community must be carefully planned and integrated to facilitate and achieve measurable and practical objectives. These may be planned through a series of educational strategies targeted at both the individual

and the community. These strategies should aim at significant members of the profession as well as those in the community.

Educating the profession to be preventive orientated is essential to the promotion of prevention in the community. By carefully selecting individual or group targets for dental health education, a more effective outcome can be achieved because of the influences of these targeted individuals on public opinion and social behaviour. For instance, in Vancouver, it was reported that a dental component was introduced to prenatal education classes because the health department recognised that pregnancy was a critical time to impact positively upon dental health habits of individual families (Lee 1984). The importance of dental health education for pregnant women is well recognised (Sunberg 1966; Seward 1967; Goins 1977). By educating the prenatal care team to develop preventive dental behaviour in pregnant women, there is a better participation of both the health workers and the women themselves in the programme, ensuring a more successful outcome. The trickle down effect of the role model of these future mothers to their children, would produce greater benefits for the health education efforts expended. This is because role modelling of mothers forms an important part of the primary socialisation of children (Blinkhorn 1981).

4.5 THE IMPORTANCE OF COMMUNICATION

In dental health education, communication is a formal process of conceptualisation in an effort to share concepts with others for the purpose of altering their oral health behaviour (Dworkin, Ference, Giddon 1978). It is the important foundation to dental health education. Communication is a two-way process involving the

transmission of messages either on a one-to-one basis or with groups of varying sizes. It requires attention, comprehension and acceptance on the part of the receiver. The message must first be received, heard or felt. It must then be understood and accepted (Dworkin, Ference, Giddon 1978).

Messages must be verified that they have been accurately received because words and gestures may have different meanings to different people. Where the communication is aimed at pregnant women, the messages must be tailored to meet the problems and interests of the group. Communication can only be effective if there is a willingness on the part of the listener or receiver to seek the information (Smith 1984).

The one-to-one communication has been found to be the most effective method of communication in dental health education (Stiffler, Young, Burt 1983). This is because consideration can be given to the direct feedback and the emotional content of communication through the observation of body language. Messages and words can be appropriately chosen and changed to suit the person's level of understanding, interest and feelings. In the one-to-one situation, non-verbal communication including the patient's posture, facial expression and movements can provide valuable clues to underlying feelings (Stiffler, Young, Burt 1983).

The non-verbal messages of the educator are equally important in communicating dental health matters. Empathy and respect for individuals receiving the education, will be shown by the choice of words and tone of communication of the educator (Dworkin, Ference, Giddon 1978). The importance of listening or feed-back by the educator cannot be over-emphasised in this two-way process. By

listening to the patient, the perceptions, attitudes, knowledge and biases of the patient can be identified and accommodated (Smith 1984).

4.6 COMMUNICATING THROUGH THE MASS MEDIA

4.6.1 Primary Objectives

Communication plays an essential role in disease prevention and health promotion. The goal of communication in preventive periodontal programmes acts in two ways. Whether it is on a face-to-face setting or in groups, the communication aims to create a greater public awareness of periodontal diseases. It also aims at stimulating individuals to adopt appropriate preventive behaviour through effective measures in the clinical setting as well as in the community environment (Bakdash, Odman, Lange 1983).

4.6.2 Successes of the Mass Media

Communication in dental health education involves both verbal and non-verbal processes as well as written educational literature and the mass media. Snegroff has stated that "mass media are an important resource if public health educators are to reach large numbers of people" (Snegroff 1983). Snegroff acknowledges the difficulty of communicating to large and diversified audiences, but he suggests that if health educators understand, analyse and apply mass communication theory and skills, the desired results for a large number of message recipients can be achieved.

The mass media can be used to initiate or reinforce thoughts, concepts, ideas, emotions, attitudes and opinions. It can be used to inform, instruct and educate the community on preventive periodontics. Gjermo suggests that systematic use of the mass media will increase

the background knowledge and alertness of the population as well as the profession. He reported as an example, a campaign for preventive periodontics in Norway. In 1981, the dental association in Norway initiated a "perio-year" during which time, emphasis was given to postgraduate education of the profession. This was followed by messages targeted to the community through the mass media (Gjermo 1984).

In 1983, Bakdash reported on the success of a televised periodontal campaign to increase public periodontal awareness (Bakdash, Lange, McMillan 1983). The campaign reached a sizable portion of the target population and positively affected their awareness. Messages were repeatedly televised over a period of 4 weeks with the television audience receiving the messages an average of $7\frac{1}{2}$ times. This level of exposure played an important role in the success of the campaign. Bakdash felt that mass communication campaigns had a role in educating the public, and were most likely to be effective if they were reinforced with personal communication (Bakdash 1979).

Televised preventive periodontal messages can be planned and screened at appropriate times according to the targeted audience. For instance, successful advertising can be tailored to meet the oral health needs and interests of pregnant women. Repetitive and appropriate messages, with creative presentations which are both informative and motivational, can be devised to appeal to the target audience. Indeed, it was reported by the American Dental Association that their "paid public education programme for national network television.....provides the most efficient and cost-effective means of reaching a national audience with a compelling message designed to change behaviour patterns" (American Dental Association 1984).

4.6.3 Supportive Reinforcements

According to Green, mass media alone will not significantly influence or motivate preventive behaviour (Green 1978). Media campaigns must be supported by additional sources of reinforcement if they are to achieve changes. To this end, Silversin and Kornacki suggested that the effect of mass media campaigns could be augmented by one-to-one instruction, self-help groups or self-instructional written material (Silversin, Kornacki 1984b). Bakdash, however, criticised written educational materials in that they tended to be set at too high a level of readability than desirable. He suggested that all health information should be written in the simplest manner possible (Bakdash, Odman, Lange 1983).

According to Silversin and Kornacki, the mass media, despite its limitations, can promote oral health if their messages continue over long periods of time, appeal to motives and are coupled with social and professional support by way of dental services. These communication efforts to prevent oral and periodontal diseases, can be planned and targeted on receptive pregnant women. The authors urged for more research into such interventions for expectant mothers (Silversin, Kornacki 1984b). Although the mass media may be successful in terms of creating awareness of periodontal diseases in the community, there is an obvious need to promote motivation for compliance with appropriate oral hygiene care throughout life.

4.7 MOTIVATION IN DENTAL HEALTH EDUCATION

Motivation refers to the forces that produce a given behaviour. These forces or needs, motivate an individual towards certain kinds of behaviour. Felkner's approach to motivation lies in

maximising positive self concept through promoting feelings of competence, worth and belonging (Bunyard 1983). According to Maslow, however, there is a hierarchy of individual needs, with the more basic physiological and security needs at the lower end of the scale (Striffler, Young, Burt 1983). Higher levels of need like social esteem and self-actualising needs do not motivate an individual until the lower and more basic needs, like food and shelter, are met.

In dental health education, it is important to motivate an individual to behavioural change based on the individual's perceived needs. It has been reported that pregnant women perceive the need for dental care during pregnancy (Doust, Radalj, Wong-Lee, Phillips 1985). This would therefore be an opportunity when dental preventive programmes can be introduced because the primary motive for seeking and accepting care has already been established.

Apart from the internal forces that motivate an individual to certain behaviours, there are other forces that shape or reinforce behaviours. These forces are based on the reward and punishment principle where individuals will adopt a behaviour that makes them feel good, and discard behaviours that make them feel unpleasant (Prisgrove, Judge, Harrison, Collins 1979).

The behaviour modification approach in dental health education uses this principle to stimulate and control behaviour. This approach requires constant repetition and feedback, and is the basis for the reinforcements in many plaque control programmes (Craft, Croucher, Dickinson 1981). This constant repetition and reinforcement is required to maintain motivation of both individuals and groups (Melcer, Feldman 1979).

At the community level, motivational efforts to induce the public to practise effective oral hygiene, have been directed through the mass media. The outcome of such campaigns is difficult to evaluate but good success has been reported by the American Dental Association in their public education programme through television, where repetition was an important requisite of the telecast message (American Dental Association 1984).

4.8 A BEHAVIOURAL APPROACH TO PERIODONTAL HEALTH PROMOTION

4.8.1 The Basic Concept

In dental health education aimed at behavioural change, the theoretical approaches to behaviour change and maintenance, must be based on a set of principles derived from systematic conceptual frameworks. This will involve operant conditioning and associative learning theories, cognitive-behavioural and self-management theories, and social learning theories (Lee, Owen 1985). These techniques are then applied to frameworks which provide a structure for considering the periodontal or oral health problems, and for the design and evaluation of interventions. These can be applied to preventive periodontal programmes in the clinic setting and in the community. They may be used to modify environmental and social factors which act as restraints for individuals to adopt preventive dental behaviours. These environmental and social barriers to change, may be economic constraints or unfavourable attitudinal factors, or just structural and organisational limitations in the environment. By having a knowledge of these situations, an appropriately planned intervention can be carried out based on a behavioural approach.

4.8.2 Principles for Promoting Behaviour Change

The efficacy of behaviour change techniques in preventive periodontal programmes can only be realised if the appropriate personal actions can be easily and conveniently carried out. The convenience of learning and practising plaque control measures and attending for regular dental examination is therefore important. For instance, individuals are more likely to practise effective oral cleansing if facilities are available not only at home but also in the workplace.

Convenient dental facilities in terms of location and appointment times contribute to accessibility for regular dental attention. In a preventive programme targeted on pregnant women, for example, it has been reported that a dental facility in a prenatal centre offered convenience to pregnant women to attend for dental examination (Doust, Radalj, Wong-Lee, Phillips 1985). The appropriateness and convenience of settings thus facilitate behaviour change.

Realistic goals must be set which can be achieved with moderate effort. Various time-related degrees of change are more achievable and less discouraging than a goal that is set at too high a level. Lower levels of activity like effective toothbrushing can be followed at a later stage with interproximal cleaning.

The use of existing organisational structures like prenatal centres, will facilitate change. These existing organisations can be developed to disseminate information and organise preventive periodontal programmes tailored to the needs of the group. Selected dental and health personnel can be trained and integrated into the existing health system without excessive costs required of a

completely new service facility (Lee, Owen 1985).

Specific interventions are more effective than general exhortation, and a programme relevant to the interests and problems of expectant mothers can be developed as appropriate. Sound information on resources and channels for making efforts towards preventive behaviour change, will enhance the rates of adoption and maintenance of preventive periodontal behaviours. Accurate information must be given for instance, to women on the nature of gingival bleeding during pregnancy. There must also be a well-defined referral system if required.

Preventive periodontal activities must be interesting and practical, taking into consideration, the personal and social constraints on individuals or community groups. For instance, a lack of manual dexterity may prevent individuals from using the dental floss. In such a situation, alternative interproximal cleaning aids should be made known and easily available.

Equity of opportunity to facilities for dental examination is all important. The availability and accessibility of such facilities must be made known to the community. Multiple level approaches to disseminate information must be utilised. These include use of the mass media, and individual or group interactions. Congruent messages from different sources should be used to focus on individuals as well as community groups. After all, the community provides the social and physical environments in which individuals must act. According to Jackson, community-based strategies must accompany individual and group behaviour interventions (Jackson 1985).

Community-based strategies, such as using lay persons within a community, to deliver dental health education, has been shown to be

effective (McKegg 1984). Participation of allied health and education personnel has been advocated by Sheiham to facilitate behaviour change (Sheiham 1983). The FDI suggests that obstetricians and nurses at prenatal care centres must receive dental health education themselves, in order to influence the preventive dental intervention of pregnant women (FDI 1984). The mass media have been successful in creating a greater awareness of periodontal diseases in the community (Bakdash, Lange, McMillan 1983; American Dental Association 1984).

4.8.3 Techniques Used for Behaviour Change

Operant conditioning and associative learning theories focus on eliciting observable behaviours brought about by environmental cues, rewards and punishment principles. This method is only suitable in an institutional setting where conditioning approaches can be used to modify behaviour in a controlled situation or environment (Jackson 1985).

Cognitive-behavioural and self-management techniques give individuals thought and choice in their actions. In this technique, individuals are involved in a contractual agreement with the setting of goals for a target behaviour. Individuals are trained to observe their own behaviours, and to change their actions to please themselves. They also have the freedom to alter their actions to suit their own convenience and satisfaction. This allows the individual greater independence and choice, resulting in longer term effectiveness (Lee, Owen 1985). Individual choice is important, because ultimately it determines an individual's behaviour (Jackson 1985).

The social learning theory is based on changing a behaviour by observing the behaviour of other individuals. Based on this

theory, an individual may also select a course of action based on past experience (Lee, Owen 1985).

Usually, a combination of different approaches to behaviour change is more superior than the use of just one single technique. An integration of techniques with a multiple method approach is necessary because of psychological and attitudinal differences between different individuals. This is also because behaviour change occurs in a highly complex socio-economic and physical environment where there are constraining or reinforcing forces affecting individuals at all times. Thus, situational and environmental factors will ultimately influence the adoption and maintenance of new behaviours.

McKegg has demonstrated that by carefully choosing a health educator from within a community, the educator could be an effective teacher because of shared cultural experiences and understanding of the community's behaviour (McKegg 1984). Doust et al. (1985) showed that by using a multiple approach, integrating cognitive-behavioural and self-management techniques, pregnant women could be helped into adopting new behaviours. The impact of the intervention was a positive favourable change in the attitudes and self reported behaviour of the women. The outcome of the dental health education process was a significant reduction in plaque and gingival scores (Doust, Radalj, Wong-Lee, Phillips 1985).

5. A COMMUNITY APPROACH TO PREVENTIVE PERIODONTICS

5.1 THE TEAM APPROACH TO PREVENTION

The community dentist must act as leader of a team in providing dental care for pregnant women. The dentist must be responsible for the overall treatment of the pregnant woman while the operating auxiliary carries out scaling and simple root planing. Dental health education can be carried out by non operating auxiliaries, specially trained in interview, counselling methods and in preventive oral care and recording procedures. McKegg has shown that these tasks can be carried out effectively even by lay persons (McKegg 1984).

The community team must also elicit the help and co-operation of allied health and educational personnel, including individuals involved with the mass media. All campaigns must be based on a situation analysis, with the dentist designing intervention based on periodic evaluation of all levels of periodontal disease prevention in individual and community programmes.

The profession must undertake a greater lead in public educational programmes to influence a greater public awareness that periodontal diseases are preventable. For instance, the American Dental Association carried out a mass media campaign which created an increased awareness of periodontal diseases in the community (American Dental Association 1984). A similar programme was initiated in Norway in 1981 through the mass media. This was a concerted effort by the dental profession to increase knowledge and alertness in the community and the profession to periodontal diseases. Emphasis on postgraduate education of the profession in periodontics, formed an integral part of this approach (Gjermo 1984).

School-based programmes would require the co-operation of educational and school authorities, to be effective (Burt 1983). Allied health personnel at prenatal centres, like obstetricians and nurses, can also contribute towards preventive dental interventions for pregnant women (FDI 1984). Thus a combined approach by both health and social leaders is needed, in an educational approach to the prevention of periodontal diseases in the community.

5.2 COMMUNITY STRATEGIES FOR PREVENTION

5.2.1 Behavioural and Social Strategies

The community dentist must lead and co-ordinate efforts to promote oral health and prevention of periodontal disease. This has to be within a programme of general health promotion to be effective (Sheiham 1983). Behavioural and social strategies are needed in a community approach to preventive periodontics.

According to the World Health Organisation, there are several approaches to achieving the goal of maintaining a functional dentition for life (WHO 1981). These are through greater oral health promotion using preventive activities at the individual and community levels.

There must also be the removal of barriers to care. The dental workforce must be utilised and distributed optimally so as to ensure the success of the service systems and the delivery of high quality care. In addition, there must be options to the community of cost-effective financing systems (Cormier, Levy 1981). Since preventive dental behaviour is associated with individuals having a higher income and education, efforts aimed at raising the socioeconomic and educational levels in a country, will contribute towards the prevention of periodontal diseases (Chen, Stone 1983).

In the area of primary prevention, periodontal health promotion aimed at behaviour change may be carried out more successfully on an individual basis and less so on a community basis (Striffler, Young, Burt 1983). Among the reaons for these lesser benefits when carrying out dental health education in the community, could be the inappropriate choice of methods and recipient groups (Burt 1983). In order to overcome this problem, Burt suggested further research by educational psychologists to identify the most favourable methods and target groups for more effective dental health education of the public (Burt 1982). For instance, significant or key individuals and target groups may be selected for dental health education programmes because of their influences on other individuals or groups in contact with them. It has been suggested that key health personnel and politicians can be educated to become more aware of periodontal diseases and their prevention (Sheiham 1984b).

Target groups like expectant mothers and mothers have been reported to be influential models on the health practices of their children (Blinkhorn 1981). Schoolchildren have usually been target groups for dental health education but many investigators have sought to improve the outcome of these programmes by involving the parents of the children (Krüger 1984; Levy 1984).

For periodontal health promotion to be effective, dental health education programmes must continue over long periods of time to be successful (Silversin, Kornacki 1984b). However, it is difficult to evaluate the effectiveness at the community level. It is interesting that well planned strategies can greatly influence the practice of preventive oral health behaviour. For instance, when the American National Dental Association's oral health committee promoted increased

awareness of oral hygiene with the dental examination of all children, the establishment of clinics for treatment and research, and a mass health education campaign, there was a widespread emergence of interest in oral health care (Davis 1980).

In contrast to the prevention of dental caries, the prevention of periodontal diseases in the community has to involve the dental practitioner. Prevention of periodontal disease is resource intensive because professional cleaning is necessary to reinforce an individual's oral hygiene practices. The cost can be made more acceptable if auxiliaries provide the service (Burt, Warner 1983). Third parties may also need to be convinced of the benefits of increased visits for professional preventive attention. Burt has suggested the introduction of some form of "package deal" by third party carriers and dental practitioners, to cover the costs of increased dental visits (Burt 1982).

Other strategies may involve removing barriers on a personal level. For instance, programmes geared to meet the needs of pregnant women must be acceptable to them. The dental team and treatment conditions, as well as the physical and psychosocial environment, must be carefully chosen, while any anticipated pain during treatment must be minimised (De Liefde 1984). These strategies to remove personal barriers to access to dental care, apply as a whole to all organised services for the community. While social and behavioural strategies are being promoted today to prevent periodontal diseases, their success rates are not predictable. This is because of the lack of socio-dental indicators in dental research (Cushing, Sheiham, Maizels 1986).

5.2.2 Treatment Strategies

Since specific bacteria have been implicated in various periodontal disease states, measures aimed at these bacteria may hold promise for treatment and prevention. For example, antibiotics have been used with impressive results in the treatment of some periodontal conditions (Genco 1981). However, the use of antibiotics as a preventive measure in the community is not acceptable because such a widespread long term use of antibiotics would be a concept which is unjustifiable and unparalleled in antimicrobial therapy or prevention. It would be more practical to limit its use to the secondary or tertiary levels of prevention, that is, during the treatment of conditions refractory to conventional therapy.

An alternative strategy aimed at specific periodontal pathogens may be by way of altering or influencing the host immune system. The success and predictable outcome of primary prevention through immunisation against childhood diseases is well known. A similar strategy could emerge one day for the prevention of periodontal diseases in the community. If research is able to conclusively identify periodontal pathogens and determine the risk factors involved in the pathogenesis of different disease states in individuals, to evaluate host immune responses and their complex interactions, measures can be developed to alter or influence the host immune system to the types of oral indigenous flora and their antigenic material (Listgarten 1979). In particular, these could be directed at preventing the establishment of periodontal pathogens. Such knowledge and strategies will have great application in the primary prevention of periodontal diseases. For example, such immunisations against specific periodontal diseases, could be carried out at different risk periods of life based

on relevant scientific research. In effect, such measures can be compared to immunisations against infectious diseases in childhood, with predictable and successful outcome on a very cost-effective basis. This may hold more promise than an educational approach.

A treatment based strategy, using antibiotics and immunisation measures, is a good strategy because the intervention is directed at the causative bacteria. Where a lesser effort is required of individual compliant behaviour, these treatment based strategies could prove more effective as a public health measure against periodontal diseases. However, these measures are either not practical or available at this point in time. An educational stragegy must therefore remain the main thrust of preventive periodontal intervention. This strategy aims at improved oral cleanliness through behavioural change, with the objective of effective mechanical cleaning. As Ainamo stated, chemotherapeutic agents will never be able to replace meticulous mechanical cleaning as a means of obtaining optimal control of gingivitis and periodontitis (Ainamo 1984).

5.3 SELECTING TARGET GROUPS FOR PREVENTIVE PERIODONTICS

5.3.1 Reasons for Selecting Target Groups

It has been said that individual behaviour is much more important in the control of periodontal disease than it is with caries (Burt 1983). The prevention and control of periodontal diseases depends on the daily oral health practice of the individual. Preventive activities are therefore important for the development of periodontally beneficial patterns of personal behaviour.

At present there is substantial controversy as to the long term changes in individual behaviour which flows from dental health education

programmes (Wright 1984). Furthermore, whether these preventive activities are organised public programmes or specific services on a personal individual basis, the cost of dental health education efforts can be considerable. As such, dental health education programmes must be made more cost-effective and directed at target groups that are receptive to preventive advice and behaviour change. Such a target group is pregnant women because they have been stated to be at a "teachable moment" in their lives (Havighurst 1972).

If the convenience of a captive group facilitates dental health education programmes, then expectant mothers may be considered such a group because of their necessity to attend ante-natal examination during pregnancy. In fact, the Fédération Dentaire Internationale has suggested that the impact of dental health education in the community may be more effective if it is aimed at specific groups such as pregnant women and obstetricians and nurses who provide pre-natal care (FDI 1984).

5.3.2 Problems of Some Target Groups

Dental health education activities have also been directed at schoolchildren who form a convenient captive group for such programmes. However, many studies have shown the limitations of success of such programmes (Horowitz, Frazier 1980). Suggestions have been made that dental health instruction should be transferred to groups of a more mature age, like adolescents (Burt 1983). Silversin and Kornacki have also suggested that peer group influences on the preventive dental behaviour of adolescents should be explored (Silversin and Kornacki 1984). However, teenagers and young adults are groups that are difficult to reach (Burt 1983).

Although incorporation of such programmes in high school education may be possible, there has been little consideration given to integrating dental health education with general health education in schools. In fact, a further problem arises in motivating high school authorities to accept periodontal health as a worthwhile achievement (Burt 1983). On the other hand, there are reports of successful dental health education in schools when there is parental involvement (Blinkhorn 1978).

5.3.3 Disadvantaged Priority Groups

Disadvantaged groups often receive priority treatment because of their inability to make demands for treatment due to a host of reasons. These reasons may be social or medical. They may be residents of nursing homes, institutionalised persons, the homebound and the chronic sick (Burt 1982). These groups are in need of preventive care because of their high levels of disease due to unmet needs (Crack, McDougall, Spencer 1980). They are thus targeted for treatment due to social and/or medical reasons.

5.4 PREGNANT WOMEN AS A TARGET GROUP

It has been observed that there is an increasing emphasis being placed on expectant women as a target group for dental preventive programmes (Heloe, Haugejorden, Heloe 1980; FDI 1984; Doshi 1985). This is because studies have indicated that mothers play a key role in the behaviour of their children (Mechanic 1964; Rayner 1970; Blinkhorn 1981). It is also being increasingly recognised that a behavioural approach to the prevention of oral disease, including periodontal diseases, is important.

According to Sheiham, toothbrushing which is essential to the control and prevention of periodontal diseases, is a social behaviour that is practised not for health reasons, but as a social norm of good grooming (Hodge, Holloway, Bell 1982; Sheiham 1984b). Therefore, the promotion of effective toothbrushing in the community should be by way of the mothers and through them, the families. This is an alternative strategy that would be applicable for the prevention of periodontal diseases based on the social model.

Recent studies have reported that there is a high compliance by pregnant women to dental health education (Doust, Radalj, Wong-Lee, Phillips 1985; McKegg 1984). McKegg demonstrated that pregnant women maintained high levels of oral cleanliness 18 months after preventive intervention during pregnancy. This consisted of an initial scaling and instructions in oral cleansing, reinforced by repeated sessions of monitoring and feedback over a period of 12 months. Doust and her co-workers found low levels of plaque in a group of pregnant women given a programme of scaling with repeated education and skill development sessions during the second trimester of pregnancy. These women maintained low levels of plaque at the post test assessment in the third trimester of pregnancy.

Many women also regard pregnancy as a cue to seeking dental care. This has resulted from sustained cultural and social conditioning. "A tooth for every child" is an old adage that is still widely believed, and reinforced by the common medical practice of advising women in their early pregnancy, to seek dental treatment (De Liefde 1984). Doust reported that 50% of pregnant women in her study group attended for dental treatment because of pregnancy (Doust, Radalj, Wong-Lee, Phillips 1985).

Considerable potential exists for the development of preventive periodontics programmes for pregnant women. Such programmes can be conveniently located in the present existing pre and post-natal health centres, and integrated within the general health education of mothers and expectant mothers. Since expectant mothers perceive a need for dental care, are highly receptive to health information, and will be important spheres of influence in the family, these dental health programmes would be highly cost-effective.

5.4.1 The Influence of Mothers on their Children

The socialisation process in children suggests that their behaviour can be shaped considerably by the family, especially the mother. Dental health education programmes for expectant mothers could well result in children being taught oral hygiene routines which are beneficial to oral health. According to the World Health Organisation, the primary socialisation process is imortant in the acquisition of knowledge, values, attitudes and routines (WHO 1979). Preventive periodontal programmes directed at expectant mothers or mothers, can thus result in highly beneficial outcomes in the long term improvement of periodontal health in the community.

Children are at a stage of developing rapid communication powers, and any behaviour adopted during this period would be rapidly internalised. Thus the development of sound oral health habits in early childhood is important (Doshi 1985). Studies have reported that mothers play the central role in the brushing practices carried out by children at home (Blinkhorn 1978). Other studies have stated that it was difficult to teach oral hygiene effectively without the parents (Silversin, Kornacki 1984a).

Mothers play a key role in the health behaviour of the family especially the children (Lee 1984). Influence her behaviour and it is passed on to her children (Blinkhorn 1981). Patterns of behaviour learnt during childhood are therefore deeply ingrained through the influence of the mother during the formative years. This process of primary socialisation enables the child to develop a set of behaviour norms which are acceptable to the immediate family and social environment (Doshi 1985).

The main aim of dental health education of mothers and expectant mothers, should thus be to create the appropriate norms of effective oral health practices, so that the behaviour pattern becomes institutionalised in the family (Blinkhorn 1981). Mothers are often concerned about the behaviour of their children. Health education of mothers and would-be mothers allows them to identify themselves as role models for their children. Through the process of role modelling, mothers will help form the oral health habits of their children (Blinkhorn 1981).

5.4.2 The Interest and Concern of Mothers for their Children

The interest and concern of mothers for the health and social betterment of their children would make mothers suitable targets for preventive health education. Due to limited resources, dental public health has largely concentrated on the oral health of children. However, according to Jeanette Rayner "It may be that by allocating public health funds largely in the interest of children's health, we unintentionally "write off" the mothers' power as well as their needs. If so, this may be a serious mistake. If children's dental (and general) health practices depend upon observing their mothers' practices, then it seems reasonable to expend some effort in the health education

of the mothers." (Rayner 1970). Silversin and Kornacki have further stated that since parental influence is the predominant socialising force in a child's life, research concerning ways of affecting parents' behaviours would help young children improve their own dental health practices (Silversin, Kornacki 1984a).

In a study reported by Kruger in which parents were involved in a preventive programme for children, it was found that there was a significant difference in outcome, in the oral health of children whose parents participated in the programme from those whose parents were not involved (Kruger 1984). In this study, Kruger reported that parents of the test group of children, were given counselling on fluoride and nutrition. They were also taught effective toothbrushing and methods of checking for tooth cleanliness in their children. The parents were further advised on attending 6 monthly dental appointments with their children when cleaning and fluoride applications were made. The programme commenced when the children were about 1 year old. At the age of 5 years, 77.9% of children of the test group were caries free as compared with 15.1% in the control group of children whose parents were not involved in the programme. This study shows that efforts to develop preventive dental health behaviour in children should be directed primarily at parents, particularly the mother (Lee 1984).

5.5 PLANNING A PREVENTIVE PERIODONTAL PROGRAMME FOR PREGNANT WOMEN

In planning a preventive periodontal programme for pregnant women in the dental public service, interest must first be created by the dental profession at the community, governmental and professional level. This is because support is needed from political, administrative and professional leaders for the programme to become feasible (Sheiham

1983). According to the World Health Organisation, "a national political will and the co-ordinated efforts of the health sector and relevant activities of other social and economic development sectors" are needed for successful implementation of preventive programmes (WHO 1981).

A preventive periodontal programme for pregnant women can be planned by leaders of the dental profession, to be incorporated within a nation's preventive health services. A dental facility at a pre-natal care centre can provide a convenient and accessible preventive dental resource for pregnant women (Doust, Radalj, Wong-Lee, Phillips 1985).

Specially trained dental health educators may be based at these centres to provide dental health education with a strong preventive periodontal component, based on behavioural strategies. This should be on a one-to-one approach to be effective (Striffler, Young, Burt 1983). The programme should aim at developing skills in oral cleansing using practical methods of feedback. The objectives of oral care can be reinforced by methods or tools for home oral hygiene support and assessment, in the form of oral hygiene aids and written literature. This is because toothbrushing is a social norm in most societies today and dental health education should stress on the effectiveness of toothbrushing, rather than the frequency (Ainamo 1984). Moreover, according to Doust, skill deficits are the major problems in oral cleansing in pregnant women (Doust, Radalj, Wong-Lee, Phillips 1985).

The aims of these programmes should be stated according to short, medium and longer term goals. In the short term, the goal would be the prevention of gingivitis during pregnancy with a reduction in the number of bleeding gingival sites as a measurable objective. In

the medium term, the oral health of pre-school children would be improved through the benefits of the mothers from the programme. The oral health status can be assessed according to measurable caries and gingival status. In the longer term, the goal would be an improved oral health status in the primary schoolchildren. These three time-related measurable goals can be presented to political and administrative decision makers with emphasis on political expediency.

The range of preventive activities at prenatal centres can be commenced initially as a dental health promotion and periodontal disease prevention programme, with dental health education as the major activity provided by specially trained dental health educators. Such a programme would be supported by an efficient system of referral if dental treatment is required.

The second stage of the programme begins when the dental health education stage is fully operational after a year. Political expediency can be used to facilitate the setting up of dental clinics at these centres to examine and treat pregnant women. Based on the diagnosis and the periodontal treatment needs using CPITN, the dentist can advise and offer treatment to the women. Pregnant women can be appropriately referred to the educators for dental health education and the operating auxiliary for scaling and simple root planing. The dentist would be responsible for the treatment plan and for the overall level of care. This would be confined to the primary and secondary levels of preventive care and exclude surgical interventions.

Training or re-orientation courses for personnel involved in the programme would be simultaneously developed. These would include dentists, operating and non-operating dental auxiliaries. McKegg has shown that lay persons can be effectively trained for the health

educator role. He showed that mothers and grandmothers within a community could assume the health educator role after a six-week period of training in interview and counselling methods, hospital routine and office systems, and in preventive home care and recording procedures (McKegg 1984). Non-operating dental auxiliaries can be similarly trained to provide dental health education at prenatal centres. Operating dental auxiliaries can be re-orientated to provide scaling and simple root planing at the centre, with emphasis on the special needs and precautions entailed in treating pregnant women. These operating auxiliaries can assess and monitor the gingival status of pregnant women by being trained in the use of CPITN.

A well planned referral system between the dentist, the operating auxiliary and the health educator, is necessary for the efficient functioning of the programme during the limited period of a woman's pregnancy. The roles of these dental personnel must be clearly defined to avoid conflict. The dentist is the leader of the dental health care team at the centre, and will be responsible for regular monitoring and evaluation of the process and outcome of the programme.

A preventive periodontal programme for pregnant women can be designed as part of a community's preventive health services. It can be incorporated and be compatible with existing prenatal services, using existing facilities. This would reduce costs and facilitate implementation. Being conveniently located, it will be accessible to all pregnant women seeking prenatal care. The following activities would be necessary in implementing such a programme:-

1. The promotion of interest and support at the community, governmental and professional level.

2. Cooperative liaison with appropriate administrative groups and with health workers involved with prenatal care.

3. Formation of a dental health care team for the prenatal centre, with the dentist as leader responsible for overall dental care, the operating auxiliary to carry out scaling and simple root planing, and the non-operating auxiliary to provide dental health education.

4. Planning and organising the range of preventive activities.

5. Development of training or re-orientation courses for personnel involved in the programme.

6. Periodic monitoring and evaluation of the process and outcome of the programme.

The preventive programme can be designed initially as a pilot project at a large prenatal care centre. When fully operational, it can serve as a model for expansion of preventive periodontal interventions in the community.

6. CONCLUSION

1. Gingivitis and periodontitis are periodontal diseases common to all populations.

2. Periodontal diseases are the result of the interplay between plaque bacteria and host responses.

3. Increased gingival inflammation is a common occurrence during pregnancy. While the exact cause has not been determined, the condition can be prevented by effective plaque control.

4. Periodontal diseases can be controlled by adequate plaque control and early diagnosis and treatment. This is achieved by effective toothbrushing and interproximal cleaning supplemented by regular professional care.

5. A greater awareness of periodontal diseases is possible through public health promotion and education campaigns. This must be reinforced by dental health education and motivation based on a behavioural approach.

6. Effective targeting is a strategy for preventive periodontal intervention. Targets should be selected for their roles in influencing preventive behaviour and in decision making processes in the community.

7. Pregnant women are an important target because they are receptive to health education and as future mothers, they become influential role models for their children in preventive dental behaviour.

8. Oral health antenatal education is an effective educational approach for developing preventive dental behaviour in pregnant women.

9. The provision of a dental team, located at a prenatal centre, will facilitate dental health education and treatment for pregnant women. This would be an effective strategy for preventive periodontal intervention in the community.

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